USING CAMEL RATINGS TO EVALUATE THE EFFECTIVENESS OF CAPITAL REGULATION

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1991

ACKNOWLEDGEMENTS

My greatest debt of gratitude is to Professors Christopher James, Mark Flannery, and Joel Houston for their excellent guidance and advice, and their unfailing support and patience. I have benefitted greatly from conversations with Professors Robert Emerson and Mark Rush. I owe a special thanks to T.S. Wong for his invaluable computer assistance, insights, and encouragement. Finally, I thank my parents for their dedication to helping me realize my goal.

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Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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August 1991

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Major Department: Finance, Insurance and Real Estate

This dissertation employs changes in CAMEL ratings to analyze the effectiveness of capital regulation of 58 bank holding companies in the period 1984Q1-1986Q4. I use means tests and Granger tests of causality to examine the relationship between past changes in CAMEL ratings and subsequent changes in primary book capital ratios, other capital-related balance sheet items and bank risk.

I also use CAMEL ratings to evaluate whether capital regulation imposes costs on stockholders. I use the standard event study methodology to examine stockholder abnormal returns around 28 bank divestiture announcements. I test whether capital adequacy at the time of the announcement is useful in explaining the size and sign of these abnormal returns.

I conclude that regulatory pressure leads to desired changes in book capital ratios at the small banks in the sample. The changes in capital are authentic; there are no apparent increases in bank risk to offset the improved capital ratios.

The behavior of the large banks in my sample is consistent with results from prior studies that support the capture theory of economic regulation. These studies reveal how the larger banks in the industry effectively use regulation to extract wealth transfers from the smaller banks. My finding that large banks do not respond to regulatory pressure to improve capital suggests that noncompliance is significantly less expensive than for the small banks in my sample. So, while I do not test directly for intra-industry wealth transfers, the evidence implies a subsidy to the large banks.

Consistent with this large bank result is my finding that for a divestiture sample dominated by large banks, capital regulation does not impose costs on bank stockholders. I base this conclusion on my finding that differences in capital adequacy do not explain cross-sectional differences in abnormal returns around divestiture announcements.

CHAPTER 1
INTRODUCTION

There is considerable anecdotal evidence that points to problems with the current system of risk regulation at commercial banks. Regulators rely on a combination of instruments, namely examination/supervision and capital requirements, to curb risk. Yet, eroding capital positions at some of the largest banks, together with the substantial losses incurred by the deposit insurance fund, suggests that these instruments do not adequately constrain bank risk-taking.[1]

Complementing the anecdotal evidence are theoretical arguments for suspecting the ineffectiveness of risk regulation. Chan, Greenbaum, and Thakor (1988) present the argument that regulators lose "bite" when monopoly rents begin to shrink. The removal of the bank's charter, which confers the right to own a bank, is the most severe penalty that regulators can impose. So, regulatory "bite" is a function of charter value, which in turn depends upon the value of future rents accruing to the bank.

Beginning with the elimination of deposit rate ceilings in the 1970s up through the passage of the Garn-St. Germain in

[1] See James (1991).

1982, the industry has been introduced to increasing amounts of competition. So, charters lose value as competition strips away rents. Faced with declining charter values, bankers arguably have less to lose and more to gain by ignoring regulators and pursuing high risk strategies.[2]

Campbell, Chan, and Marino (1990) question whether examination and supervision can adequately reduce moral hazard. We observe that regulators' compensation is not at all contingent upon the solvency of the bank. Campbell et al. show that without this link, regulators lack the incentive to engage in first-best level of monitoring.

Chan et al. and Campbell et al. allow for heterogeneity across banks in their response to risk regulation. Historically, the impact of bank regulations has not been indiscriminate. The discrimination is usually evidenced by an intra-industry wealth transfer. For example, the deposit insurance premium per dollar of insurable deposits is uniform across banks. Yet, the informal designation of some banks being "too big to fail," which implies that the government provides total deposit insurance for the same premium, creates a wealth gain at expense of those banks without this guarantee of solvency. (See O'Hara and Shaw, 1990.) Further there is evidence of intra-industry wealth transfers arising from the

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[2] The introduction of competition does not affect all charters in the same way. Some charters may not have suffered any decline in value; such institutions would then have an incentive to comply with risk regulation.

passage of the 1980 Depository Institutions Deregulation and Monetary Control Act (Allen and Wilhelm, 1988) and the removal of deposit rate ceilings (James, 1983).

Extensive empirical evidence of intra-industry wealth transfers following changes in regulation is consistent with a cartel of banks co-opting bank regulators. (See Stigler, 1971 for a discussion of the capture theory of economic regulation.) Similarly, a cartel could use noncompliance with risk regulation to extract a subsidy from the complying banks in the industry. Such a manipulation would manifest itself as a differential bank response to risk regulation.

While these arguments suggest that risk regulation may be ineffective (or at best selectively effective), there is no recent empirical evidence on this issue. The focus of my research is an investigation of the effectiveness of capital regulation. I begin by assuming that if effective, banks will respond to a signal from regulators that primary book capital is not adequate. CAMEL ratings provide the signal.[3] I continue by examining whether banks that comply with regulatory demands effect real or illusionary changes in capital ratios. I also

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[3] The Federal Reserve, the Office of the Comptroller, and the Federal Deposit Insurance Corp have used the CAMEL rating system since 1978 to evaluate the health of banks. The system involves five ratings, one for capital adequacy (C), asset quality (A), management (M), earnings (E), and liquidity (L). Regulators also provide a composite or overall rating. The ratings are kept confidential between the regulator and the directors of the bank.

examine adjustments in risk that offset the protection gained from an increased capital cushion.

For a sample of 58 banks, I find that regulators on average influence book capital ratios. Further, these banks do not resort to window-dressing, nor do they increase risk.

My sample consists of publicly traded bank holding companies that range in asset size from $1.5 billion to $130.6 billion.[4] While all the banks are large, they are not homogeneous, in that they vary in size, leverage, and portfolio composition. This heterogeneity allows a test for intra-industry differences in response to capital regulation.

I pose two forms of a differential response hypothesis. The first states that the effectiveness of capital regulation varies indirectly with the asset size of the bank. I base this on the prior empirical evidence that supports bank regulators being co-opted by the larger banks in the industry.[5] I test this form of the hypothesis by comparing the response of the

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[4] These figures are based on the average asset size of each bank in the sample over the period of study, 1984Q1-1986Q4.

[5] Allen and Wilhelm (1988) reveal that the passage of DIDMCA allowed Federal Reserve System (FRS) banks to gain at the expense of the non-FRS banks and thrifts. The 38 FRS banks are consistently larger than the 19 thrifts and the 16 non-FRS banks comprising their sample. James (1983) shows that the elimination of deposit rate ceilings was more beneficial to wholesale than retail commercial banks. The average wholesale bank had roughly four times the asset size of the average retail bank.

smallest one-third of the sample with that of the largest one-third.[6]

An alternate statement of the hypothesis is the following: capital regulation is less effective for banks that are deemed "too big to fail" than for banks deemed "too small to save." As discussed in O'Hara and Shaw (1990), "too big to fail" banks have an implicit government guarantee of total deposit insurance. Arguably, banks with such a guarantee could view noncompliance with regulatory demands as being less expensive than banks without this guarantee. To test this form of the hypothesis, I compare the response of the 11 "too big to fail" banks that are identified in O'Hara and Shaw (1990) with the remaining 47 banks in my sample.

I cannot show that small and large banks respond differently to regulatory demands for capital. Yet, I can show that the small banks in the sample are driving the full sample result that regulators effectively control book capital. These conclusions are invariant to the definitions of large and small banks.

As a final issue, I test the hypothesis that capital regulation imposes a cost on bank shareholders. Slovin, Sushka, and Polonchek (1989) describe this cost as arising from capital regulation forcing divestitures that would not otherwise occur. I test this hypothesis by analyzing the

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[6] I choose these two groups to maximize the difference in asset size and still maintain an adequate number of observations to perform the statistical tests.

extent to which differences in market returns at divestiture announcements can be explained by differences in regulatory pressure. I find no support for the hypothesis.[7]

I organize the remainder of the dissertation in the following manner. Chapter 2 provides a description of measures of regulatory pressure, statements of the null hypotheses that test regulators' ability to control capital ratios, and a discussion of the methodology. Chapter 3 summarizes the results of the tests described in Chapter 2. Chapters 4 and 5 continue the analysis by looking at regulatory impact on changes in specific capital-related balance sheet items and risk, respectively. Chapter 6 examines the divestiture issue. In Chapter 7, I summarize the principal results from the prior chapters, and show their consistency. I also note the major policy implication of my research.

[7] This is not surprising since the divestiture sample is clearly dominated by large banks, which do not appear to be receptive to regulatory demands to recapitalize.

CHAPTER 2
REGULATION OF CAPITAL RATIOS: HYPOTHESES AND METHODOLOGY

Background

Peltzman (1970), Mingo (1975), Dietrich and James (1983), and Marcus (1983) look at whether book or market capital ratios reflect regulatory influence in the 1960s and 1970s. Keeley (1988) undertakes a similar examination for the 1980s. These studies test a null hypothesis of no positive correlation between changes in capital ratios and a proxy for regulatory pressure. A rejection of the null hypothesis is consistent with effective capital regulation.

The studies offer various proxies for regulatory pressure. Peltzman (1970), Mingo (1975), and Dietrich and James (1983) employ proxies equal to the ratio of adequate capital to actual capital. These studies measure adequate capital by various formulae suggested by the Federal Reserve, the FDIC, and the Comptroller. Marcus (1983) uses a variable that shows whether a bank's annual capital ratio falls below the average annual ratio of the sample. (This is an attempt to mimic the peer comparisons that characterized capital regulation in the 1970s.) Keeley (1988) applies the 1985 primary capital requirement of 5.5% to distinguish sample banks under regulatory pressure.

Examinations of the 1960s and 1970s test the null hypothesis by regressing the current annual change in the capital (or capital ratio) on the proxy for regulatory pressure, usually lagged one year.[1] The regression results generally lead to a failure to reject the null hypothesis. So, capital regulation in the 1960s and 1970s does not appear to be effective. Mingo (1975) represents the one exception. Yet, Dietrich and James (1983) argue that Mingo's finding of significant influence results from binding deposit rate ceilings.[2]

Keeley (1988) hypothesizes that the December 1981 regulatory regime shift, which established minimum capital requirements, increased regulatory control of capital.[3] To test this hypothesis, he examines 1981-1986 annual mean primary book and market capital ratios of bank holding companies for which the 1985 capital requirements are binding.

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[1] These studies generally define capital as the sum of book value of stockholders' equity and loan loss reserves. Marcus (1983) is the only study to employ a measure of market capital. He defines market capital as the sum of the market value of equity and an estimate of the market value of non-deposit debt.

[2] Dietrich and James (1983) argue that when deposit rate ceilings are binding, banks resort to increasing capital ratios to lure depositors. The additional safety afforded by larger capital ratios compensates lenders for accepting a below market rate of interest. Therefore, studies of capital regulation during periods of binding deposit rate ceilings (such as Mingo (1975)) risk falsely attributing influence to regulators.

[3] The new standards represent a major departure from the loosely defined, subjective pre-1981 policy.

He compares these means with those of banks for which the requirements are not binding. The book capital comparison shows that capital-deficient banks engaged in significantly greater positive adjustments than did the capital-sufficient banks. Yet, capital-deficient banks did not raise significantly more market capital. Keeley concludes that the book capital results support his hypothesis that the regime shift improved regulatory control of capital.

Two aspects of Keeley's data prevent him from controlling for other economic events, concurrent with the regime shift, that caused the capital changes.[4] First, Keeley has only one regime shift in the period he examines. Second, his two groups of bank holding companies differ in many respects besides capital levels. For example, the capital-deficient banks had average assets of $129.2 billion in 1981, whereas the capital-sufficient banks had average assets of $18.6 billion. The former group of banks was largely multi-national in focus and had fewer core deposits as a percent of total deposits than the latter group.

Because he fails to control for the lack of homogeneity between the capital-deficient and capital-sufficient banks, his results based on one regime shift are open to an alternate explanation. The capital-deficient banks, with strikingly

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[4] Such economic events include deregulation, onset of lower interest rates, and greater profit opportunities provided by an expanding economy. Peltzman (1970) is the first to show that interest rates (profit expectations) is negatively (positively) related to bank capital.

different investment portfolios, could have been better positioned to take advantage of the economic and deregulated environment of the 1980s. So, greater capital gains accrued to the capital-deficient banks than to the capital-sufficient banks. The differential growth in capital gives the appearance of regulatory influence, when regulators are not responsible.

An analysis of several regime shifts (or changes in regulatory pressure) or of more closely matched capital-deficient and sufficient banks would strengthen Keeley's conclusions. For the present study, I adopt the first approach. Thirty-one banks in my sample of 58 experience at least one change in capital adequacy rating in the 1984-1986 period. For hypothesis testing, I interpret the rating change as a measure of the change in regulatory pressure. Because these changes in pressure can occur at different times for different banks, I design tests for the whole sample that better control for the effects of unobserved variables than Keeley's tests.

My study differs from Keeley's in another respect. I use CAMEL ratings to imply regulatory pressure. All existing studies of regulatory influence on capital **proxy** regulatory opinion about the adequacy of capital. By using the ratings, I can avoid proxies for regulatory opinion, and produce a better measure of regulatory pressure.

Using CAMEL Ratings to Measure Regulatory Pressure

Central to an examination of effective capital regulation is the issue of how to measure regulatory pressure. I have CAMEL ratings, which provide regulatory opinion of capital adequacy, asset quality, management, earnings, and liquidity. There is also a composite score that I refer to as the overall rating. The ratings range from 1 (best) to 5 (worst). I use the information the ratings provide to construct measures of regulatory pressure. The possibilities are numerous. First, one can argue that the **level** of the rating captures regulatory pressure, i.e., the lower is the rating, the greater is the regulatory pressure. This measure raises the issue of whether the five levels indicate five distinct degrees of regulatory pressure.

On the other hand, one can examine a bank's response to a **change** in rating. This measure raises the issue of whether equivalent changes imply the same increment in regulatory pressure, or whether the **level** of the rating before or after the change leads to a different incremental change in regulatory pressure. In other words, is the incremental change in regulatory pressure the same when a bank falls from a 1 to a 3 as when it falls from a 3 to a 5?

Then there is the issue of which is the appropriate CAMEL component to evaluate the effectiveness of capital regulation. One would suspect that the capital adequacy rating is the principal indicator of pressure on banks to improve capital

ratios. Yet, there may be other aspects of the bank's operations that may influence regulatory pressure. A bank that has a weak capital position is not necessarily weak in other respects. So, banks with similarly weak capital positions may not be subject to the same amount of regulatory pressure. To capture this possibility requires a measure of regulatory pressure that is based on the capital adequacy rating, but adjusted to reflect perhaps the overall condition of the bank.

The principal advantage provided by CAMEL ratings is the avoidance of proxies for regulatory opinion. Yet, a weakness arises from the lack of a guiding principal to develop a single scheme for converting the rating scale into measures of regulatory pressure. I resort to a manageable degree of experimentation with three schemes.[5] The first emphasizes absolute changes in ratings. The second and the third combine rating changes with rating levels to produce proportional changes in rating.

Table 1 summarizes the measures of regulatory pressure that I use in hypothesis testing. I refer to the first measure under Scheme 2 as a dichotomous measure of regulatory pressure, which separate banks under much regulatory pressure from banks presumed to be under little regulatory pressure.

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[5] The test methodologies, which I discuss in the next section, influence the development of these schemes.

TABLE 1
SUMMARY OF THE MEASURES OF REGULATORY PRESSURE

Scheme	Measures of Regulatory Pressure
#1	1. Any change in capital adequacy rating.
#2	1. Capital rating change to a 3, 4, or 5 or no change from a 3, 4, or 5 vs. capital rating change to a 1 or no change from a 1. 2. Change in capital adequacy rating times the capital adequacy rating for the prior quarter.
#3	1. Change in capital adequacy rating times the overall rating for the prior quarter.

The second measure under 2 is the multifid counterpart of the first measure. I allow any change among the five levels of capital rating to represent a degree of regulatory pressure. Scheme 1 is a similar multifid measure of regulatory pressure, but it does not consider prior or resulting levels of the rating. Finally, under Scheme 3, I define measures of regulatory pressure that include regulatory opinion about the overall condition of the bank.[6]

My motivation for deriving the dichotomous measure under Scheme 2 is the following. Banks that drop to an overall rating of 3 typically trigger greater regulatory scrutiny than 1 or 2 rated banks. In particular, banks are labeled "problem banks" if they are assigned an overall rating of 4 or 5.

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[6] All but the dichotomous measure are based on the following assumption: if regulatory pressure is capture by changes in rating, then no change in rating implies no incremental change in pressure. As a result, one would not expect an incremental change in capital ratios.

Problem banks are judged to pose a threat to the insurance fund if their problems are not corrected.[7] Regulators can be motivated to enforce sanctions on banks at the level of 3 or worse. These sanctions can include cease-and-desist orders, removal of bank officers and directors, and the threat of termination of deposit insurance. Regulators can also withhold approval on various types of applications such as branching or holding company expansion.[8]

This distinction between 1 and 2 rated banks versus 3, 4, or 5 rated banks logically suggests a dichotomous measure of regulatory pressure.[9] I eliminate the ratings of 2 so to create the sharpest contrast between banks under a little pressure and banks under much pressure.[10]

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[7] See French (1991) for a regulatory interpretation of each level of CAMEL ratings.

[8] Joseph F. Sinkey, Jr., Commercial Bank Financial Management in the Financial Services Industry (New York: Macmillan Publishing Company, 1989), 621.

[9] This distinction is based on the overall CAMEL rating, yet I derive the dichotomous measure from the capital adequacy component since my focus is on capital regulation. If I regress the overall rating on the capital rating, the coefficient is .839. The t-statistic for the null hypothesis that the coefficient is insignificant from zero is 31.147, which is significant at the 1% level. Given these regression results, banks with capital ratings of 3 or worse are likely to face the regulatory interference that ensues from a similar overall rating.

[10] A bank whose capital rating improves to a 1 or remains at a 1 could be under no regulatory pressure. This would provide the ideal comparison. Yet, I am hesitant to assume, strictly on the basis of the capital component of CAMEL, that such banks are under no regulatory pressure.

Hypotheses

The principal null hypothesis states that increases in regulatory pressure do not lead to increases in capital ratios. All prior studies of the effectiveness of capital regulation have tested this null hypothesis. These studies tend to interpret a rejection of the null as an indication that regulators influence capital ratios.

For the present study, I define capital ratios in two ways:

1. book capital ratio, which is the ratio of the sum of stockholders' equity, and perpetual preferred stock to the book value of lead bank assets, and

2. market capital ratio, which is the ratio of the product of the price per share of common stock and the number of shares outstanding to the book value of bank holding company assets.

Regulators define capital requirements in terms of book value, so they ostensibly regulate book capital. Yet, regulatory control of book capital does not necessarily imply control of market capital, which may more closely approximate the deposit insurer's exposure to losses.[11] (Market capital will understate the exposure if it contains the value of the

[11] There are accounting gimmicks that allow management to window-dress their capital accounts. Such gimmicks include the sale of a depreciated asset whose selling price exceeds its historical cost and the use of standby letters of credit. Both can increase book capital ratios without a corresponding increase in market capital ratios. I discuss these gimmicks more fully in Chapters 4 and 6.

deposit insurance subsidy.[12]) One can test directly for control of market capital by examining changes in market capital ratios. Alternatively, to avoid any bias produced by a deposit insurance subsidy, one can indirectly test for regulatory control of market capital by examining whether mandated increases in book capital are authentic or illusionary. Market capital will reflect authentic, but not illusionary, increases in book capital.[13]

A second null hypothesis arises from prior evidence that the impact of regulation on banks has not been indiscriminate. O'Hara and Shaw (1990), Allen and Wilhelm (1988) and James (1983) support the notion that the larger banks in the industry, through changes in regulation or implicit government guarantees, have extracted wealth from the smaller banks.

To examine this issue within the framework of capital regulation, I test the null hypothesis that the effectiveness of capital regulation is independent of the size of the bank. A rejection of this null hypothesis because the effectiveness of capital regulation diminishes as bank size increases would

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[12] Brickly and James (1986) provide evidence consistent with the market value of equity impounding the value of a deposit insurance subsidy. They show that increases in value of access to deposit insurance result in a decrease in the co-movement of thrift stock returns with the return on the thrift's assets, exclusive of deposit guarantees.

[13] I explore direct tests of regulatory control of market capital ratios in Chapter 3. Subsequently, in Chapter 4, I form conclusions about the effectiveness of market capital regulation from tests that examine the authenticity of changes in book capital.

suggest the following conclusion. For the large banks in the sample, noncompliance is significantly less expensive than for the small banks. Alternatively, capital regulation is providing a subsidy to the larger banks in the sample.

To test this null hypothesis, I require a method for distinguishing small banks from large banks in the sample. My sample consists of 58 publicly traded bank holding companies that range in asset size from $1.5 billion to $130.6 billion.[14] Since the alternative hypothesis states that effective capital regulation is an indirect, albeit unspecific, function of relative asset size, I divide the sample into thirds to provide maximum size difference and yet preserve observations. The largest 20 banks have a mean asset size of $40 billion, a median of $28 million, and a range from $7 billion to $130 billion. Comparable figures for the smallest 19 banks are $2.5 billion, $2.4 billion, and $1.5 billion to $3.3 billion.

There is an alternate statement of the null hypothesis: the effectiveness of capital regulation does not vary between banks deemed to be "too big to fail" and banks deemed to be "too small to save." This tests for a link between the effectiveness of capital regulation and the implicit government guarantee of total deposit insurance to a select group of banks. O'Hara and Shaw (1990) provide a list of 11

[14] These figures are based on the average asset size of each lead bank in the sample over the period of study, 1984Q1-1986Q4.

banks that the Wall Street Journal in 1984 identified as being "too big to fail" (TBTF). Since these 11 banks are in my sample, I can test for a differential response to regulators by comparing the behavior of the large 11 banks with the small 47 banks.[15]

The mean and median size of the 11 TBTF banks are $55 billion and $62 billion, respectively. In Table 2, I list the 11 TBTF banks and their average asset size. The remaining 47 banks have a mean size of $5.4 billion, a median of $4.05 billion, and a range from $1.5 billion to $21.9 billion.

Methodology

Introduction. My methodology consists of two tests: means tests and Granger causality tests. I use each to test the null hypothesis that increases in regulatory pressure do not lead to changes in capital ratios. I then repeat the tests of the null for the large and small bank samples.[16] By comparing the test results across these two samples, I form conclusions about differences in large and small bank response to regulators.

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[15] The key difference between the forms of the differential response hypothesis is the emphasis on relative size (the largest one-third of the sample versus the smallest one-third) versus absolute size (the 11 TBTF banks versus the remaining 47 banks that are "too small too save.")

[16] I use both definitions of large and small banks that I discussed in the previous section.

TABLE 2
THE "TOO BIG TO FAIL" BANK SAMPLE

Bank	Asset Size[a] (billions)
Wells Fargo	25.691
Continental Illinois	30.662
First Chicago	34.856
Security Pacific	41.739
Bankers' Trust	47.454
Chemical Bank	55.387
Manufacturers Hanover	60.708
J.P. Morgan	65.332
Chase Manhattan	80.322
Bank of America	104.972
Citibank	130.594

[a] These figures are based on the average asset size of the lead bank over the period of study, 1984Q1-1986Q4.

The type of test dictates how changes in regulatory pressure will be defined in the null hypothesis. For the means tests, I use the dichotomous measure defined under Scheme 2 in Table 1. For the Granger causality tests, I use the dichotomous measure under Scheme 2 and the multifid measures under Schemes 1, 2, and 3. The rationale for my choices will become apparent as I discuss the test methodologies.

Means tests: full sample. Keeley (1988) uses a series of means tests to evaluate differences between capital-deficient and sufficient banks' annual book and market capital ratios for six years following the 1981 regime shift. His measure of regulatory pressure is dichotomous; banks that in 1981 do not meet the 1985 capital requirement are under pressure, whereas banks for which the requirement is not binding are under no pressure.

For comparison purposes, I carry out means tests that are similar to Keeley's. I examine cumulative growth in book and market capital for quarters t+1 through t+5 for banks that at quarter t remain or fall to a rating of 3 or worse and for banks that remain or improve to a rating of 1.[17] The former

[17] Unlike the six years of annual capital ratios examined by Keeley, the five quarters of cumulative growth in capital can be temporally different for the banks in the two groups. So, I can better minimize the impact of any unobserved variables on the test outcome.

I use five quarters because I believe this to be a reasonable time period for banks to react to regulatory demands. Keeley uses six years (1981-1986) because the initial standards implemented in 1981 were adjusted first in 1983 and then in 1985. By 1985, the standards were uniform across of

group is assumed to be under much regulatory pressure, whereas the latter group is assumed to be under little regulatory pressure. If cumulative growth is significantly greater for the banks under much regulatory pressure, then I conclude, like Keeley, that regulators are effective in controlling capital.

Means tests: large versus small banks. Examination of the differential response hypothesis, which states that the effectiveness of capital regulation diminishes as asset size increases, requires two sets of means tests. First, I perform the means test as described for the full sample for the largest 20 and the smallest 19 banks. I then repeat the exercise for the 11 TBTF banks and the remaining 47 banks. By doing so, I am testing the following two null hypotheses:

(1). H01: For the large banks in the sample, increases in regulatory pressure do not lead to increases in capital ratios, and

(2). H02: For the small banks in the sample, increases in regulatory pressure do not lead to increases in capital ratios.

Yet, the outcome of these tests alone does not prove whether the large and small banks are responding differently to regulators. An additional test is required. Assume that A, B, C, and D in Figure 1 represent the possible responses to regulators in terms of bank size and regulatory pressure.

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all bank holding companies.

	Large Bank	Small Bank
Much Pressure	A	B
Little Pressure	C	D

Figure 1

A test of A-C = 0 and B-D = 0 are equivalent to the null hypotheses H01 and H02. To test whether the large and small banks are responding differently to regulators requires the null hypothesis A-C = B-D. This test is equivalent to testing two additional null hypotheses: A-B = 0 and C-D = 0. If I reject A-B = 0 because A is significantly less than B, then I have evidence of the differential response hypothesis.

Means tests: conclusion. I primarily use the means tests to provide a basis of comparison with Keeley's results. These tests also represent an uncomplicated first pass at testing a somewhat complex issue. Yet, the means tests suffer from a major drawback: they treat the change in capital rating as exogenous. Therefore, they do not control for the impact of changes in capital that occurred prior to the rating change. An indication of temporal causality from rating changes to ratio changes would strengthen means tests conclusions that support effective capital regulation. So, I test for the possibility that changes in ratings are "Granger-causing" changes in capital ratios.

Granger tests: full sample. To implement Granger tests of causality, I form two null hypotheses:

(1). H03: Quarterly changes in regulatory pressure are not causally prior to quarterly changes in capital ratios, and

(2). H04: Quarterly changes in capital ratios are not causally prior to quarterly changes in regulatory pressure.

Other terms interchangeable with causally prior are statistically informative and Granger-causing. The terms have the following interpretation. If prior changes in regulatory pressure permit one to predict the current change in book capital ratios with a smaller error, then regulatory pressure is statistically informative (causally prior) to changes in book capital ratios.

I include H04 because of my a priori belief that changes in regulatory opinion are not exogenous, and are most likely influenced by lagged capital structure changes.

A rejection of the null hypothesis H03 implies that prior changes in regulatory pressure influence the current change in capital ratios. I indicate the direction of the influence by testing whether the linear combination of the coefficients of the lagged changes in regulatory pressure is significantly different from zero.

As an initial Granger causality test, I focus only on H03, and I define the change in regulatory pressure as a dummy variable: $PRESSURE_{dum} = 0$, if the capital rating improves to a 1 or stays at a 1, and $PRESSURE_{dum} = 1$, if the capital rating

declines to a 3, 4, or 5, or stays at a 3, 4, or 5.[18] This dichotomous measure of regulatory pressure is the same as employed in the means tests.

To test H03, I first estimate an unrestricted version of model 1:

$$DCAP_{it} = \alpha_1 + \sum_{j=1}^{4} a_j DCAP_{i(t-j)} + \sum_{j=1}^{4} b_j PRESSURE_{i(t-j)} + \psi_{t1} \quad (1)$$

DCAP is the quarterly change in capital ratios, and PRESSURE is replaced with $PRESSURE_{dum}$. I then restrict the coefficients b_1 through b_4 in model 1 to zero. To find causal priority, I show whether the restricted or unrestricted model 1 produces the better prediction of DCAP. This requires a F statistic with degrees of freedom equal to the number of restrictions and the number of observations less the number of independent variables.

If I reject H03, I expect that the sum of the coefficients b_1 through b_4 will be significantly greater than zero. This would be consistent with banks under much regulatory pressure producing greater changes in book capital ratios than banks under little regulatory pressure. If I find this to be true, then I have strengthened similar means test

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[18] I dismiss H04 for this measure, $PRESSURE_{dum}$, because a test of H04 would require a model with a dummy dependent variable and dummy lagged dependent variables. Such a model is virtually impossible to interpret in a Granger test context.

results because I have controlled for the impact of prior changes in capital ratios on the current change.[19]

Then I turn to three additional aspects of the regulatory process that require examination. First, I test for "feedback" effects from lagged changes in capital to current changes in regulatory pressure. Second, I allow any change (absolute and proportional) among the 5 levels of capital rating to represent a degree of regulatory pressure. Finally, I allow other aspects of the bank's condition to influence the degree of regulatory pressure.

To examine these aspects, I use all the measures of regulatory pressure defined in Table 1, except for the dichotomous measure (the first measure under Scheme 2). I introduce these measures here as

1. $PRESSURE_{unadj} = (-1*CAPRATE_t) - (-1*CAPRATE_{t-1})$, where CAPRATE is the quarterly capital adequacy rating;

2. $PRESSURE_{cap} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1}))*CAPRATE_{t-1}$; and

3. $PRESSURE_{all} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1}))*OVERALL_{t-1}$, where OVERALL is the quarterly CAMEL overall rating;

The multiplication of ratings by -1 allows declines in rating to produce a negative number and increases to produce a positive number. Regression coefficients will be easier to interpret with the rating scaled in this manner. Note that a

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[19] I am assuming that non-regulatory adjustments in current capital ratios are embodied in the lagged changes in capital ratios. So, if regulatory pressure provides an additional adjustment, then I will be able to reject H03.

constant rating from t-1 to t will be recorded as a zero, irrespective of the level of the rating.

$PRESSURE_{cap}$ allows a test of whether the effectiveness of regulatory pressure is limited to situations where the likelihood of intense regulatory supervision and enforcement of sanctions is the greatest. I examine this issue by comparing the Granger test results based on $PRESSURE_{cap}$ with those based on $PRESSURE_{dum}$. A rejection of H03 with $PRESSURE_{dum}$, but not with $PRESSURE_{cap}$ suggests that for 58 banks in my sample, all possible changes in rating do not represent degrees of effective regulatory pressure.

I include $PRESSURE_{all}$ to capture other aspects of the bank's operations that may influence regulatory pressure. Like $PRESSURE_{cap}$, this measure also provides tests of the effectiveness of each proportional change in regulatory pressure.

To test the null hypotheses H03 and H04, I estimate restricted and unrestricted versions of the following two models:

$$DCAP_{it} = \beta_1 + \sum_{j=1}^{4} c_j DCAP_{i(t-j)} + \sum_{j=1}^{4} d_j PRESSURE_{i(t-j)} + e_{t1} \quad (2)$$

$$PRESSURE_{it} = \theta_1 + \sum_{j=1}^{4} e_j PRESSURE_{i(t-j)} + \sum_{j=1}^{4} f_j DCAP_{i(t-j)} + v_{t1}. \quad (3)$$

PRESSURE is either $PRESSURE_{unadj}$, $PRESSURE_{cap}$, or $PRESSURE_{all}$. A test of H03 restricts the coefficients d_1 through d_4 in model 2 to zero. To test H04, I restrict the to zero coefficients f_1 through f_4 in model 3. I summarize the possible test outcomes in Table 3.

I refer to the rejection of H01 as the **anticipatory** response by regulators. There are two forms of this response. Either regulators **predict** changes in capital ratios or they **influence** changes. The interpretation of the anticipatory response depends on the significance of the sum of the coefficients d_1 through d_4. If the sum is significantly greater than zero, then regulators anticipate changes in capital ratios by lowering (raising) ratings prior to a decrease (increase) in book capital. A significantly negative sum suggests that regulators anticipate DCAP by lowering ratings before an improvement in the capital ratio. This latter interpretation of the anticipatory response is consistent with regulators influencing capital changes.

I refer to a rejection of H02 as the **reactive** regulatory response. A positive sum of the coefficients f_1 through f_4 is the only reasonable possibility. A rejection of both H01 and H02, i.e., a finding of feedback, is consistent with regulators reacting to past changes in capital ratios and influencing future changes. This interpretation of feedback requires that the sum of the coefficients d_1 through d_4 be significantly negative.

TABLE 3
POSSIBLE TEST OUTCOMES

MODEL 2

Granger Test results	$\sum_{j=1}^{4} d_j$	Conclusion
Reject H01 (Anticipatory Response)	significantly greater than zero	Regulators predict but do not influence ratio changes.
	significantly less than zero	Regulators influence ratios.

MODEL 3

Granger Test results	$\sum_{j=1}^{4} f_j$	Conclusion
Reject H02 (Reactive Response)	significantly greater than zero	Regulators react to capital changes.
	significantly less than zero	not a reasonable sign

Granger tests: large versus small banks. To analyze if the large banks behave differently from the small banks, I test H03 for both samples. If I reject H03 for the small banks, but not for the large banks, I perform a Chow test to validate that the two samples are responding to regulators in a significantly different manner. The statistic for the Chow test is the following:

$$F\ statistic = \frac{\frac{(ESS_R - ESS_{UR})}{k}}{\frac{ESS_{UR}}{(N+M-2k)}}$$

ESS_R is the residual sums of squares of the estimate of model 2 for the full sample; ESS_{UR} is the sum of the residual sums of squares of the large bank and small bank estimates of model 2. The number of restrictions, k, is equal to nine since there are eight regressors and an intercept term. The number of degrees of freedom in the unrestricted model are the sum of N (the observations in the large bank sample) and M (the observations in the small bank sample) minus twice the number of restrictions.

The null hypothesis states that restricting the coefficients to be equal across the two samples does not significantly reduce the explanatory power of the model; ESS_R is not significantly larger than ESS_{UR}. A rejection of the null hypothesis indicates that the two samples are sufficiently different and should not be pooled.[20] So if I reject H03 for the small banks only, and I reject the Chow test null hypothesis, I have evidence consistent with a differential response.

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[20] Robert S. Pindyck and Daniel L. Rubinfeld, Econometric Models and Economic Forecasts (New York: McGraw-Hill Book Company, 1981), 123-124.

CHAPTER 3
REGULATION OF CAPITAL RATIOS: TEST RESULTS

Description of the Data

This study uses data that are principally described in James (1988). The sample has 58 bank holding companies (BHCs), each of which is contained in the Compustat Bank file during 1984Q1-1986Q4. For BHCs in the sample, the assets of the lead bank average 90% of the holding company assets. Balance sheet items for lead banks are obtained from Call reports. Balance sheet items and monthly stock prices for bank holding companies are obtained from Compustat.[1]

I obtained the quarterly CAMEL ratings for each lead bank from the FDIC. Generally, ratings are assigned at the time of an on-site examination. The frequency of these exams range from once a year to once every three years. The frequency of the exams for a particular bank depends on its rating, with lower rated banks being evaluated more often.

Off-site examinations and visitations, which are not full-scale examinations, can also lead to changes in ratings.

[1] There are three items that I collect from a different version of the Compustat tape to supplement the James' data: quarterly income before extraordinary items, liquid assets, and total dividends declared. As a consequence, I have five fewer banks for examining liquid assets, and three fewer banks for examining quarterly income before extraordinary items, and total dividends declared.

Regulators have in place a surveillance system that alerts them of deteriorating conditions and the possible need for a rating change or a full-scale examination. So while I do not know the dates of the examinations that led to the ratings for my sample, I am inclined to interpret a constant rating over a series of quarters as no change in regulatory opinion about a bank's condition.[2]

Figure 2 illustrates the distribution of the rating changes (improvements versus declines) over the 12 quarters in 1984-1986. Fourteen of the 45 rating changes (31%) occur in 1984Q2 and 1984Q3. Fourteen banks produce the 16 rating declines for which at least one subsequent quarter of data is available to monitor the response of the banks. Twenty-six banks produce the 29 rating improvements. Nine banks experiencing a decline in rating also experience an improvement. Finally, there are 27 banks in the sample for which no change in rating occurs over the 12 quarter period.

In Table 4, I provide descriptive statistics for the sample of 58 banks. I then replicate the statistics for banks or lead banks with a capital adequacy rating of 1 and with a capital adequacy rating of 3,4, or 5.[3]

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[2] This information about how CAMEL ratings are determined comes from conversations with George E. French, Chief, Financial Markets Section, Division of Research and Statistics, Federal Deposit Insurance Corp.

[3] I eliminate the banks with a rating of 2 to highlight any differences between banks that regulators consider to be well-capitalized and those that they consider to be poorly capitalized and require close monitoring. Further, I have no

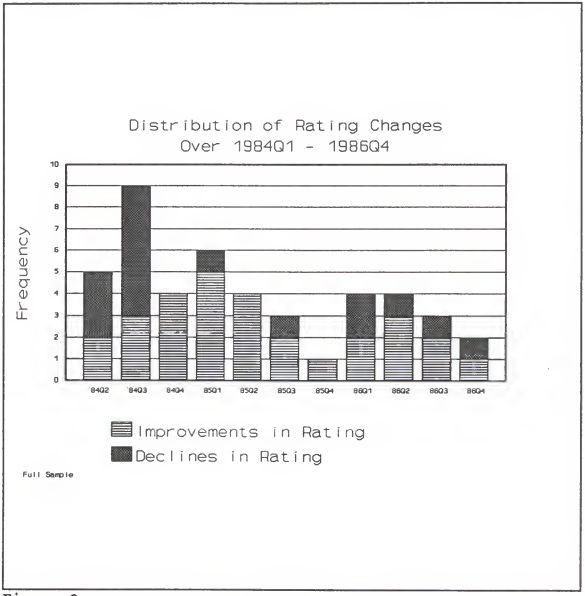

Figure 2

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evidence to date that suggests that the degree of regulatory pressure differs significantly among the three lowest ratings.

The average primary book capital ratio for the sample is 5.69%, which exceeds the 1985 minimum requirement of 5.5%. A median of 5.52% suggests that over the period examined, 50% of the observations of quarterly primary capital ratios exceeded the 1985 minimum requirement. So the sample is divided equally between observations for which the capital requirement is not binding and observations for which the requirement is binding.

A comparison of capital adequate banks (rating of 1) with capital inadequate banks (rating of 3, 4, or 5) reveals the following. The mean difference between primary book capital ratios is 1.82%. For market capital ratios, the mean difference is 5.22%. Both mean differences are significantly different from zero at the 1% level.

The capital adequate banks represent the smaller banks in the sample, whereas the capital inadequate banks are the larger banks. The mean difference in total bank holding company assets is $19.634 billion. The capital adequate banks have less exposure to foreign operations than do the capital inadequate banks. The mean difference in foreign deposits ratio is -7.11%. Both mean differences are significantly different from zero at the 1% level.

Finally, the capital adequate banks appear to be less risky than the capital inadequate banks. Three measures of risk, liquid asset ratio, CD premium and standby letters of credit ratio, reveal mean differences between the two groups

TABLE 4
DESCRIPTIVE STATISTICS FOR
SAMPLE OF 58 BANKS AND BANK HOLDING COMPANIES
1984Q1-1986Q4
(ALL VALUATIONS OCCUR AT QUARTER-END)

Overall Sample

	Primary Book Ratio[a] (BKCAP)	Market Capital Ratio[b] (MKCAP)	Liquid Asset Ratio[c] (LOWRATIO)	Average Large CD Premium[d] (PREM)	Foreign Deposits Ratio[e] (FDDEP)	Standby Letters of Credit Ratio[f]	Tot. Book Assets of BHC (Billions)
Mean	0.0569	0.0668	0.2957	0.0105	0.1221	1.1198	$18.156
Median	0.0552	0.0610	0.2814	0.0096	0.0515	0.5693	$ 5.521
Standard Deviation	0.0126	0.0350	0.1041	0.0125	0.1490	1.1553	$30.792
OBS	696	683	633	692	696	696	691

TABLE 4--continued

Sample Banks With a Quarterly Capital Adequacy Rating of 1.

	Primary Book Ratio[a] (BKCAP)	Market Capital Ratio[b] (MKCAP)	Liquid Asset Ratio[c] (LOWRATIO)	Average Large CD Premium[d] (PREM)	Foreign Deposits Ratio[e] (FDDEP)	Standby Letters of Credit Ratio[e]	Tot. Book Assets of BHC (Billions)
Mean	0.0677	0.0953	0.3410	0.0083	0.0936	0.6503	$ 8.815
Median	0.0625	0.0909	0.3168	0.0079	0.0063	0.2813	$ 3.844
Standard Deviation	0.0166	0.0367	0.1001	0.0109	0.1658	0.8577	$15.276
OBS	179	179	166	179	179	179	179

TABLE 4--continued

Sample Banks With a Quarterly Capital Adequacy Rating of 3, 4, or 5.

	Primary Book Ratio[a] (BKCAP)	Market Capital Ratio[b] (MKCAP)	Liquid Asset Ratio[c] (LOWRATIO)	Average Large CD Premium[d] (PREM)	Foreign Deposits Ratio[e] (FDDEP)	Standby Letters of Credit Ratio[f]	Tot. Book Assets of BHC (Billions)
Mean	0.0495	0.0431	0.2408	0.0139	0.1647	1.5675	$28.449
Median	0.0489	0.0383	0.2464	0.0129	0.1528	1.0917	$ 5.439
Standard Deviation	0.0112	0.0264	0.0817	0.0122	0.1511	1.2971	$38.773
OBS	109	106	96	109	109	109	106

[a] Primary Book Ratio = (shareholders equity+loan loss reserves+perpetual preferred stock)/total book value of the assets of the lead bank of a holding company.

[b] Market Capital Ratio = (market price*shares outstanding)/total book value of the assets of the bank holding company.

[c] Liquid Asset Ratio = (cash+treasuries+municipals+agencies+other taxable securities)/total book value of the assets of the bank holding company.

[d] Average Large CD Premium = ((the quarterly interest costs on jumbo CDs/the weighted average maturity of jumbo CDs outstanding for the quarter)*4) - the quarterly annualized yield on t-bills.

[e] Foreign Deposits Ratio = total foreign deposits/total deposits of the bank or lead bank of the holding company.

[f] Total Standby Letters of Credit Ratio = (foreign and domestic standby letters of credit)/the book equity capital of the lead bank.

of 10.02%, -0.56%, and -91.72% respectively. All differences are significantly different from zero at the 1% level.

Table 4 suggests a positive contemporaneous correlation between the book and market capital ratio and regulatory opinion about capital adequacy.[4] There is a similar correlation between liquidity and regulatory opinion, while the correlation between foreign deposits or standby letters of credit and regulatory opinion is negative. When assigning a capital rating, perhaps regulators do not look at capital ratios in isolation. This would be consistent with the statement in the Commercial Banks Examiner's Manual (1984 ed., Section 900.503.1, p.3) that examiners, when assessing capital ratings, should consider the following:

1. the volume of risk assets;
2. the volume of poorly performing assets; and
3. management's ability to operate the bank with its current capital level.

To examine further the relationship between capital ratings and bank characteristics, I estimate six versions of model (5).

$$CAPRATE_{it}=\alpha_1+\sum_{j=0}^{1} a_j CAPRATIO_{i(t-j)}+\sum_{t=0}^{1} b_t RISK_{i(t-j)}+e_{t1}. \qquad (5)$$

[4] There is a positive correlation between opinion and capital level, i.e. the higher is the capital level, the higher is regulatory opinion. This produces a **negative** correlation between capital levels and capital ratings because a lower numbered rating implies high regulatory opinion.

CAPRATE is a dichotomous random variable that has a value of 0 (1) when capital rating has a value of 1 (3, 4, or 5).[5] I define CAPRATIO in two ways:

1. BKCAP, which is the quarterly ratio of the sum of stockholders' equity and perpetual preferred stock to the total book value of lead bank assets, and
2. MKCAP, which is the quarterly ratio of the market value of common equity (quarter-end price times shares outstanding) to the total book value of holding company assets.

Finally, I define RISK in three ways:

1. LOWRATIO, which is the ratio of low-risk assets to total book value of holding company assets;
2. PREM, which is the risk premia on large CDs, and
3. SLCRATIO, which is the ratio of total standby letters of credit to the total book value of lead bank equity.

I estimate the relationship described in (5) as a logit model. I include one capital ratio measure and one risk measure in each version of model (5) to test if both affect the probability of a bank receiving a high (1) or low (3, 4, or 5) rating. I expect CAPRATE and CAPRATIO to be negatively correlated, i.e, the lower is the capital ratio, the greater is the probability that the bank will receive a 3, 4 or 5 rating. I expect a similar correlation between LOWRATIO and CAPRATE, since low values of LOWRATIO signify greater risk. I expect SLCRATIO and PREM to be positively correlated with CAPRATE, since low values of either measure suggest low risk.

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[5] I am estimating the logit model to examine the relationship between capital ratings and the bank characteristics that are exhibited in Table 4. There I eliminate the 2 rated banks so to provide the sharpest contrast between poorly capitalized and well-capitalized banks. So, I elect to eliminate 2 rated banks from the estimation of the logit model as well.

I include lagged values of the variables to gauge the timeliness of the information regulators use to assign ratings. The book value position of the bank at quarter-end is not available until some time after quarter-end. So, I expect that lagged values of balance sheet data will be more significant than the current values.

I report the estimates of the six versions of model (5) in Table 5. The first lag of BKCAP consistently has a negative and significant coefficient. (See Models 5a, 5c, and 5e.) The first lag of MKCAP is negative and significant in Models 5b and 5f. Since market data are available without a lag, I expected the current value to be significant. The result may arise from MKCAP being a proxy for BKCAP, and not a true determinant of the capital rating.

Risk appears to play a role in the determination of capital ratings. In Model 5a, the coefficient of the current value of PREM is significant and of the appropriate sign. In Model 5b, coefficients of current and lagged PREM are positive and significant.

The model estimates suggest that regulators use current information measures of risk and lagged capital structure information to assess capital ratings. This is consistent with my hypothesis that the unavailability of timely balance

TABLE 5
LOGIT REGRESSION OF CAPITAL ADEQUACY RATING
ON VARIOUS RISK MEASURES AND CAPITAL RATIOS:
COEFFICIENTS (STANDARD ERRORS)

Independent Var.[a]	Lag	Model 5a	Model 5b
CONSTANT	0	6.204** (1.08)	2.566** (0.51)
BKCAP[b]	0	-3.320 (35.61)	NA
BKCAP	1	-132.5** (37.2)	NA
PREM[c]	0	50.10** (18.8)	46.11* (19.3)
PREM	1	28.88 (18.82)	62.50** (20.7)
MKCAP[d]	0	NA	-28.99 (16.0)
MKCAP	1	NA	-35.85* (16.6)
PSEUDO R^2		0.4208	0.5277
OBS		262	260
Independent Var.	Lag	Model 5c	Model 5d
CONSTANT	0	8.74** (1.29)	7.25** (1.21)
BKCAP	0	50.33 (39.60)	NA
BKCAP	1	-162.86** (42)	NA
LOWRATIO[e]	0	-11.65 (6.17)	-4.453 (7.12)
LOWRATIO	1	1.00 (6.13)	-6.435 (6.91)
MKCAP	0	NA	-19.62 (26.85)
MKCAP	1	NA	-33.51 (17.93)
PSEUDO R^2		0.5086	0.5780
OBS		240	240

TABLE 5--continued

Independent Var.	Lag	Model 5e	Model 5f
CONSTANT	0	9.25** (1.67)	3.41** (0.62)
BKCAP	0	19.10 (34.54)	NA
BKCAP	1	-185.96** (40)	NA
SLCRATIO[f]	0	-28.31 (15.4)	-34.15 (19.5)
SLCRATIO	1	20.66 (15.2)	33.58 (19.4)
MKCAP	0	NA	-17.03 (16.39)
MKCAP	1	NA	-43.33* (17.60)
PSEUDO R^2		0.40	0.4639
OBS		262	260

* significance level is 5% or greater.
** significance level is 1% or greater.
a The dependent variable in Models 5a through 5f is a dichotomous variable equal to 1 if capital rating equals 3, 4, or 5, and 0 if capital rating equals 1.
b BKCAP is the primary book capital ratio.
c PREM is the premia on large CDs.
d MKCAP is the ratio of market capital to book value of holding company assets.
e LOWRATIO is the ratio of low-risk assets to total holding company assets.
f SLCRATIO is the ratio of total standby letters of credit to the book value of total lead bank assets.

sheet data may force regulators to use prior quarter information to assess the adequacy of capital.

Now that I have described the sample and the nature of the capital adequacy rating, I turn to the means tests of whether regulators influence capital. These tests use exclusively the capital adequacy rating.

Means Tests of the Issue

Results: full sample. In Figure 3, I separate banks likely to be under much regulatory pressure from banks likely to be under little regulatory pressure. The first group has banks that either (1) experience a rating decline (at quarter t) to a 3, 4, or 5, or (2) experience no change in rating (at quarter t) from a 3, 4, or 5. The latter group has banks that either (1) experience a rating improvement to a 1, or (2) experience no change in rating from a 1. I then depict the mean cumulative growth in book capital ratios at quarters t+1 through t+4.

In Table 6, I perform tests on the differences revealed in Figure 3. If regulators are controlling book capital, I expect to find the banks under much regulatory pressure generating significantly greater cumulative growth in book capital than banks under little regulatory pressure.

Table 6 suggests regulators have influence over book capital ratios. The mean cumulative growth for banks under much regulatory pressure is significantly greater than for

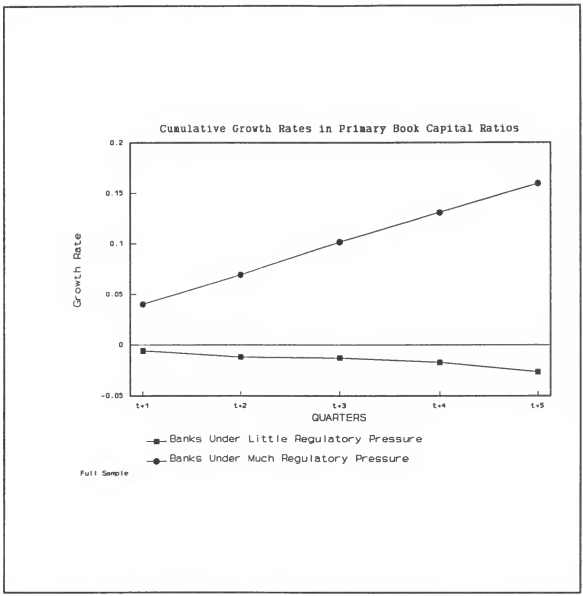

Figure 3: The cumulative change in book capital ratios is measured as ln(capital ratio$_{t+n}$/capital ratio$_t$), where n=1 to 5.

TABLE 6
MEAN CUMULATIVE GROWTH IN PRIMARY
BOOK CAPITAL RATIOS:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
FULL SAMPLE

	QT_{t+1} [a]	QT_{t+2} [b]	QT_{t+3} [c]	QT_{t+4} [d]	QT_{t+5} [e]
(A) Banks Under Much Regulatory Pressure[g]	0.040 (0.135)[f] n=85	0.069 (0.165) n=78	0.102 (0.191) n=71	0.131 (0.226) n=62	0.160 (0.263) n=55
(B) Banks Under Little Regulatory Pressure[h]	-0.006 (0.073) n=148	-0.012 (0.073) n=129	-0.013 (0.094) n=111	-0.017 (0.083) n=93	-0.026 (0.104) n=77
(A) - (B)	0.046	0.081	0.114	0.148	.186
t-stat[i] (d.f)	3.381** (231)	4.851** (205)	5.395** (180)	5.772** (153)	5.641** (130)

** significant at 1% level (two-tailed test).

* significant at 5% level (two-tailed test).

a Cumulative growth rate at $QT_{t+1} = \ln(BKCAP_{t+1}/BKCAP_t)$, where BKCAP is the ratio of primary book capital to total book value of lead bank assets.

b Cumulative growth at $QT_{t+2} = \ln(BKCAP_{t+2}/BKCAP_t)$.

c Cumulative growth at $QT_{t+3} = \ln(BKCAP_{t+3}/BKCAP_t)$.

d Cumulative growth at $QT_{t+4} = \ln(BKCAP_{t+4}/BKCAP_t)$.

e Cumulative growth at $QT_{t+5} = \ln(BKCAP_{t+5}/BKCAP_t)$.

f Standard deviation.

g These banks experienced (at quarter t) a decline in rating to a 3, 4 or 5 or experienced no change in rating from a 3, 4 or 5.

h These banks experienced (at quarter t) an increase in rating to a 1 or experienced no change in rating from a 1.

i The reported t-statistics are based on equal variances across the two samples. Statistics that are based on unequal variances (when applicable) attain comparable significance levels.

banks under little regulatory pressure. These results are comparable to those of Keeley (1988). He also finds significant regulatory influence on primary book capital ratios.

In Figure 4, I depict mean cumulative growth in market capital ratios. Only quarters t+4 and t+5 produce differences in growth in that are significant at the 5% level or better. Figures 4 suggests that using market capital ratios to evaluate capital regulation will add little to the analysis based on book capital ratios. Clearly market capital ratios, irrespective of regulatory pressure, are improving for the banks in the sample. This upward trend in market capital ratios could bias tests of regulatory impact on capital toward acceptance of effective market capital regulation. Further, I would gain little by detrending the series to eliminate the systematic influences on market capital. The resulting series would likely resemble book capital ratios. So, I decide at this point to forgo any additional analysis of market capital ratios.

Means tests: large versus small banks. In Tables 7 and 8, I compare the cumulative growth in book capital ratios for the largest 20 banks (Table 7) and smallest 19 banks (Table 8) under much and little regulatory pressure. I then discuss tests of the two forms of the differential response hypothesis. The first states that the effectiveness of capital regulation is indirectly related to bank size. The

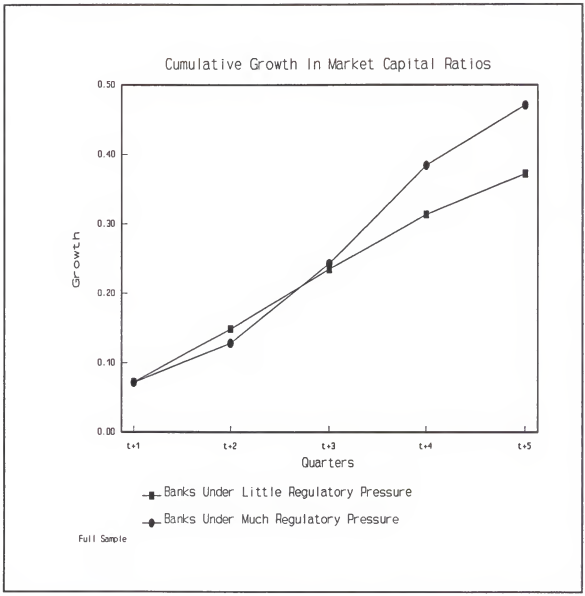

Figure 4: The cumulative change in market capital ratios is measured as ln(capital ratio$_{t+n}$/capital ratio$_t$), where n=1 to 5.

TABLE 7
MEAN CUMULATIVE GROWTH IN PRIMARY
BOOK CAPITAL RATIOS:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
THE LARGEST 20 SAMPLE BANKS

	QT_{t+1} [a]	QT_{t+2} [b]	QT_{t+3} [c]	QT_{t+4} [d]	QT_{t+5} [e]
(A) Banks Under Much Regulatory Pressure[g]	0.039 (0.154)[f] n=38	0.057 (0.171) n=35	0.075 (0.191) n=33	0.092 (0.205) n=30	0.110 (0.230) n=27
(B) Banks Under Little Regulatory Pressure[h] (OBS)	0.003 (0.050) n=26	0.015 (0.068) n=23	0.017 (0.090) n=20	0.012 (0.101) n=17	0.009 (0.110) n=14
(A) - (B)	0.036	0.042	0.058	0.080	0.101
t-stat[i] (d.f)	1.15 (62)	1.13 (56)	1.28 (51)	1.50 (45)	1.56 (39)

[a] Cumulative growth at $QT_{t+1} = \ln(BKCAP_{t+1}/BKCAP_t)$, where BKCAP is the ratio of primary book capital to total book value of lead bank assets.

[b] Cumulative growth at $QT_{t+2} = \ln(BKCAP_{t+2}/BKCAP_t)$.

[c] Cumulative growth at $QT_{t+3} = \ln(BKCAP_{t+3}/BKCAP_t)$.

[d] Cumulative growth at $QT_{t+4} = \ln(BKCAP_{t+4}/BKCAP_t)$.

[e] Cumulative growth at $QT_{t+5} = \ln(BKCAP_{t+5}/BKCAP_t)$.

[f] Standard deviation.

[g] These banks experienced (at quarter t) a decline in rating to a 3, 4 or 5 or experienced no change in rating from a 3, 4 or 5.

[h] These banks experienced (at quarter t) an increase in rating to a 1 or experienced no change in rating from a 1. The reported t-statistics are based on equal variances across the two samples. Statistics that are based on unequal variances (when applicable) attain comparable significance levels.

TABLE 8
MEAN CUMULATIVE GROWTH IN PRIMARY
BOOK CAPITAL RATIOS:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
THE SMALLEST 19 SAMPLE BANKS

	QT_{t+1}[a]	QT_{t+2}[b]	QT_{t+3}[c]	QT_{t+4}[d]	QT_{t+5}[e]
(A) Banks Under Much Regulatory Pressure[g]	0.052 (0.128)[f] n=32	0.101 (0.177) n=28	0.177 (0.213) n=23	0.261 (0.266) n=18	0.331 (0.309) n=15
(B) Banks Under Little Regulatory Pressure[h]	-0.010 (0.087) n=81	-0.018 (0.075) n=72	-0.017 (0.103) n=63	-0.024 (0.081) n=54	-0.034 (0.104) n=46
(A) - (B)	0.062	0.119	0.194	0.285	0.365
t-stat[i] (d.f)	3.00** (111)	4.80** (98)	5.67** (84)	7.00** (70)	6.97** (59)

** significant at 1% level (two-tailed test).
* significant at 5% level (two-tailed test).
a Cumulative growth at $QT_{t+1} = \ln(BKCAP_{t+1}/BKCAP_t)$, where BKCAP is the ratio of primary book capital to total book value of lead bank assets.
b Cumulative growth at $QT_{t+2} = \ln(BKCAP_{t+2}/BKCAP_t)$.
c Cumulative growth at $QT_{t+3} = \ln(BKCAP_{t+3}/BKCAP_t)$.
d Cumulative growth at $QT_{t+4} = \ln(BKCAP_{t+4}/BKCAP_t)$.
e Cumulative growth at $QT_{t+5} = \ln(BKCAP_{t+5}/BKCAP_t)$.
f Standard deviation.
g These banks experienced (at quarter t) a decline in rating to a 3, 4 or 5 or experienced no change in rating from a 3, 4 or 5.
h These banks experienced (at quarter t) an increase in rating to a 1 or experienced no change in rating from a 1.
i The reported t-statistics are based on equal variances across the two samples. Statistics that are based on unequal variances (when applicable) attain comparable significance levels.

second states that capital regulation is less effective for the "too big to fail" (TBTF) banks than for the "too small to save" banks.

The smallest 19 banks under much regulatory pressure increase capital significantly more than small banks under little regulatory pressure. Yet, this is not true for the largest 20 banks in the sample. So I conclude that regulatory pressure affects book capital ratios at the smallest banks, but not at the largest banks in the sample. If I eliminate the largest 20 banks from the sample and perform the means tests on the remaining 38 banks, I find results that are similar to those based on the smallest 19 banks. So, I conclude that the smaller banks are driving the conclusion that capital regulation is effective for the full sample.

To determine if the large bank response to regulators is significantly different from that of the small banks, I perform one additional means tests. I test the difference in the mean cumulative growth in book capital for the largest 20 banks and smallest 19 banks under much regulatory pressure. If I show that the mean differences are significantly negative, I then have support for the differential response hypothesis.

In quarters t+4 and t+5, small banks under much regulatory pressure have significantly greater growth in book capital ratios than large banks under identical pressure. So, defining large and small banks as the largest and smallest

third of the sample provides support for the differential response hypothesis.

An alternative definition of large and small banks produces somewhat different results. If I reproduce Tables 7 and 8 for the 11 TBTF banks and the remaining 47 banks, I again reach the conclusion that the smaller banks in the sample are driving the conclusion that capital regulation is effective for the full sample. Yet, I cannot conclude that larger 11 banks are responding to regulatory pressure in a manner that differs from the smaller 47 banks. For the large and small banks under much regulatory pressure, none of the differences in mean cumulative growth in book capital ratios are significantly different from zero.

Conclusion. Like Keeley (1988), I use a dichotomous measure of regulatory pressure to show that capital regulation is effective for the full sample. The evidence on a possible differential response to regulators is mixed. On the one hand, I am confident that the small banks (however they are defined) are responsible for the conclusion of effective capital regulation for the full sample. Yet, a conclusion about a significant difference in bank response to regulators depends on the definition of large and small banks. A comparison of the 11 TBTF banks with the remaining 47 banks produces no results consistent with the differential response hypothesis. A test of this hypothesis based on the largest one-third and the smallest one-third of the sample suggests that the

effectiveness of capital regulation decreases with asset size.[6]

In the next phase of the examination, I perform Granger causality tests. I use Granger tests to (1) control for the impact of past changes in capital ratios on the current change, and (2) evaluate the "feedback" effects from prior changes in book capital ratios on current changes in regulatory pressure. Neither of these can be done well with the use of the means tests. Also, the measures of regulatory pressure that I use in the Granger tests allow for a finer sorting of degrees of regulatory pressure than I have used in the means tests.

Granger Causality Tests of the Issue

Preliminaries. Recall from Chapter 2 that my first task is to estimate the model in (6).

$$DBKCAP_{it} = \alpha_1 + \sum_{j=1}^{4} a_j DBKCAP_{i(t-j)} + \sum_{j=1}^{4} b_j PRESSURE_{i(t-j)} + \psi_{t1} \quad (6)$$

DBKCAP is the quarterly change in book capital ratios ($\ln(BKCAP_t/BKCAP_{t-1})$). PRESSURE is replaced with $PRESSURE_{dum}$, which is a dummy variable that equals 1 if the capital rating remains or falls to a 3 or worse and 0 if capital rating

[6] The discrepancy in the results could arise from some of the "too small to save" banks behaving as though they are "too big to fail." So, including these banks in the former category blurs the distinction between small and large banks.

remains or improves to a 1. Testing the null hypothesis $b_1 = b_2 = b_3 = b_4 = 0$ is similar to the means tests. The test is stronger than the means tests because I control for the impact of prior changes in book capital ratios on the current ratio change.

Then I estimate the models in (7) and (8).

$$DBKCAP_{it} = \beta_1 + \sum_{j=1}^{4} c_j DBKCAP_{i(t-j)} + \sum_{j=1}^{4} d_j PRESSURE_{i(t-j)} + e_{t1} \quad (7)$$

$$PRESSURE_{it} = \theta_1 + \sum_{j=1}^{4} e_j PRESSURE_{i(t-j)} + \sum_{j=1}^{4} f_j DBKCAP_{i(t-j)} + v_{t1}. \quad (8)$$

DBKCAP is defined as in (6), but I use sequential definitions of PRESSURE, which are

1. $PRESSURE_{unadj} = (-1*CAPRATE_t) - (-1*CAPRATE_{t-1})$, where CAPRATE is the quarterly capital adequacy rating;

2. $PRESSURE_{cap} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1}))*CAPRATE_{t-1}$, and

3. $PRESSURE_{all} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1}))*OVERALL_{t-1}$, where OVERALL is the quarterly overall CAMEL rating.

These three definitions of PRESSURE primarily aid in determining (1) any "feedback" effects from changes in ratio to changes in rating, and (2) the effectiveness of regulatory pressure less extreme than heighten regulatory supervision and the enforcement of sanctions.

I pool cross-section time series data. To estimate the models 6, 7, and 8, I need stationary time series. So, to

check the stationarity assumption, I derive correlograms using the 11 transformed observations for 10 of the 58 banks in my sample.[7] The Box-Pierce Q statistic suggests that for any of the transformed time series in my sample, there is no significant serial correlation for lags up to 10.

Results: entire sample. In Table 9, I present the Granger test results that use $PRESSURE_{dum}$, $PRESSURE_{unadj}$, $PRESSURE_{cap}$ and $PRESSURE_{all}$. I also include the sum of the coefficients of lags of the independent variable, and the t-statistic for the test of the null hypothesis that the sum is insignificantly different from zero.

The Granger test based on the dummy variable $PRESSURE_{dum}$ suggests that past regulatory pressure is statistically informative about current changes in book capital ratios. Further, the sign of the coefficients of lagged $PRESSURE_{dum}$ is a significant .05, which is consistent with effective capital regulation.

I am unable to reject the null hypothesis that PRESSURE is not causally prior to DBKCAP, where PRESSURE is either $PRESSURE_{unadj}$, $PRESSURE_{cap}$, or $PRESSURE_{all}$. Yet, changes in book capital ratios (DBKCAP) are causally prior to all measures of

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[7] Recall that I have 12 quarters of data for each bank. This produces 11 observations of changes in capital ratios for each bank.

I select the 10 banks so that they are representative of the differences among the banks in my sample, i.e. money center versus regional, etc. Having captured the heterogeneity across the banks in this subset, I am comfortable in not deriving correlograms for all 58 banks.

TABLE 9
GRANGER TEST RESULTS AND COEFFICIENT ESTIMATES
FOR THE RELATIONSHIP BETWEEN PRESSURE AND DBKCAP:
FULL SAMPLE

Models 6 and 7: Causal Priority From PRESSURE to DBKCAP[a]

Granger Test: Null Hypothesis	F test (D.F.)	$\sum_{j=1}^{4} b_j$ or d_j (t-stat)
Coefficients on lagged $PRESSURE_{dum}$[b]=0	3.55** (4,113)	0.05406 (2.776)**
Coefficients on lagged $PRESSURE_{unadj}$[c]=0	1.22 (4, 397)	0.00213 (0.091)
Coefficients on lagged $PRESSURE_{cap}$[d]=0	1.43 (4, 397)	0.0090 (1.26)
Coefficients on lagged $PRESSURE_{all}$[e]=0	1.44 (4,397)	0.006 (0.676)

Model 8: Causal Priority From DBKCAP to PRESSURE

Granger Test: Null Hypothesis	F test (D.F.)	$\sum_{j=1}^{4} f_j$ (t-stat)
Coefficients on lagged DBKCAP = 0 ($PRESSURE = PRESSURE_{unadj}$)	2.59* (4, 397)	1.2011 (2.77)**
Coefficients on lagged DBKCAP = 0 ($PRESSURE = PRESSURE_{cap}$)	3.53** (4, 397)	3.358 (2.42)**
Coefficients on lagged DBKCAP = 0 ($PRESSURE = PRESSURE_{all}$)	3.302** (4,397)	3.171 (2.544)**

TABLE 8--continued

* indicates significance level of 5% or greater (two-tailed).

** indicates significance level of 1% or greater (two-tailed).

a DBKCAP = $\ln(BKCAP_t/BKCAP_{t-1})$, where $BKCAP_t$ is the primary book capital ratio at quarter t.

b $PRESSURE_{dum}$ = 0, if the capital rating improves to a 1 or stays at a 1, and $PRESSURE_{dum}$ = 1, if the capital rating declines to a 3, 4, or 5, or stays at a 3, 4, or 5.

c $PRESSURE_{unadj} = (-1*CAPRATE_t) - (-1*CAPRATE_{t-1})$, where CAPRATE is the capital adequacy rating for quarter t.

d $PRESSURE_{cap} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1})) * CAPRATE_{t-1}$.

e $PRESSURE_{all} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1})) * OVERALL_{t-1}$, where OVERALL is the quarterly overall CAMEL rating.

PRESSURE. The sum of the lagged coefficients of DBKCAP is a significant 1.20 ($PRESSURE_{unadj}$), a significant 3.36 ($PRESSURE_{cap}$), and a significant 3.17 ($PRESSURE_{all}$). The positive correlation between prior DBKCAP and current measures of PRESSURE is consistent with regulators reacting to changes in primary book capital ratios.different from zero. This result is consistent with the estimation of the logit models 5a, 5c, and 5e, which reveals that the lagged value of the book capital ratio is significant in determining the level of capital rating.

Results: the largest 20 sample banks. In Table 10, I report the Granger test results for the largest 20 banks in the sample.[8] The measures of regulatory pressure are $PRESSURE_{unadj}$, $PRESSURE_{cap}$, and $PRESSURE_{all}$.

With one exception, the largest bank results based on $PRESSURE_{unadj}$, $PRESSURE_{cap}$, and $PRESSURE_{all}$ are the same as for the full sample. The exception arises when tests on the largest banks reveal no causal priority running from DBKCAP to PRESSURE. So, the Granger tests on the largest 20 banks suggest that PRESSURE and DBKCAP are independent.[9]

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[8] Estimation of model 2 using $PRESSURE_{dum}$ is not possible for the largest banks in the sample. The matrix of independent variables is non-invertible.

[9] Granger tests on the 11 TBTF banks produce the same conclusions.

TABLE 10
GRANGER TEST RESULTS AND COEFFICIENT ESTIMATES
FOR THE RELATIONSHIP BETWEEN DRATING AND DBKCAP:
THE 20 LARGEST SAMPLE BANKS

Model 7: Causal Priority From PRESSURE to DBKCAP[a]

Granger Test: Null Hypothesis	F test (D.F.)	$\sum_{j=1}^{4} d_j$ (t-stat)
Coefficients on lagged $PRESSURE_{unadj}$[b]=0	0.925 (4, 131)	0.0190 (0.607)
Coefficients on lagged $PRESSURE_{cap}$[c]=0	1.227 (4, 131)	0.0064 (0.814)
Coefficients on lagged $PRESSURE_{all}$[d]=0	0.930 (4,131)	-0.0005 (-0.05)

Model 8: Causal Priority From DBKCAP to PRESSURE

Granger Test: Null Hypothesis	F test (D.F.)	$\sum_{j=1}^{4} f_j$ (t-stat)
Coefficients on lagged $PRESSURE_{unadj}$[b]=0	1.77 (4,131)	1.6560 (2.268)*
Coefficients on lagged $PRESSURE_{cap}$[c]=0	2.242 (4,131)	6.303 (2.648)**
Coefficients on lagged $PRESSURE_{all}$[d]=0	1.932 (4,131)	5.827 (2.565)**

* indicates significance level of 5% or greater (two-tailed).

** indicates significance level of 1% or greater (two-tailed).

[a] $DBKCAP = \ln(BKCAP_t/BKCAP_{t-1})$, where $BKCAP_t$ is the primary book capital ratio at quarter t.

[b] $PRESSURE_{unadj} = (-1*CAPRATE_t) - (-1*CAPRATE_{t-1})$, where CAPRATE is the capital adequacy rating for quarter t.

TABLE 10--continued

[c] $PRESSURE_{cap} = ((-1*CAPRATE_{t}) - (-1*CAPRATE_{t-1})) * CAPRATE_{t-1}$.

[d] $PRESSURE_{all} = ((-1*CAPRATE_{t}) - (-1*CAPRATE_{t-1})) * OVERALL_{t-1}$, where OVERALL is the quarterly overall CAMEL rating.

Results: the smallest 19 sample banks. In Table 11, I report the Granger test results for the smallest 19 banks in the sample. The measures of regulatory pressure are $PRESSURE_{dum}$, $PRESSURE_{unadj}$, $PRESSURE_{cap}$, and $PRESSURE_{all}$.

The Granger test results based on $PRESSURE_{dum}$ suggest that regulators influence changes in book capital ratios of the smallest sample banks. (The sum of the lagged coefficients of $PRESSURE_{dum}$ is a significant 0.10.) These results are consistent with the conclusion based on the means tests that I present in Table 8.[10]

I am unable to reject H01 when I measure regulatory pressure as $PRESSURE_{unadj}$, $PRESSURE_{cap}$ or $PRESSURE_{all}$.[11] Yet, I can reject the null hypothesis of no causal priority running from DBKCAP to PRESSURE, when I define PRESSURE as $PRESSURE_{cap}$ or $PRESSURE_{all}$, but not as $PRESSURE_{unadj}$. Yet, the sum of the lagged coefficients of DBKCAP is consistently insignificant from zero at the 5% level or better. So, I cannot conclude the direction of the influence of DBKCAP on either measure of PRESSURE.[12]

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[10] I reach a similar conclusion if I define the small banks as all but the 11 TBTF banks in the sample.

[11] When I define the small banks as all but the 11 TBTF banks, I can reject H01 when I measure regulatory pressure as $PRESSURE_{cap}$, but the sum of the coefficients is not different from zero.

[12] Defining small banks as all but the 11 TBTF banks produces the same test results.

TABLE 11
GRANGER TEST RESULTS AND COEFFICIENT ESTIMATES
FOR THE RELATIONSHIP BETWEEN PRESSURE AND DBKCAP:
THE 19 SMALLEST BANKS

Models 6 and 7: Causal Priority From PRESSURE to DBKCAP[a]

Granger Test: Null Hypothesis	F test (D.F.)	$\sum_{j=1}^{4} b_j$ or d_j (t-stat)
Coefficients on lagged $PRESSURE_{dum}$ $^{b}=0$	3.702** (4,57)	0.104 (2.91)**
Coefficients on lagged $PRESSURE_{unadj}$ $^{c}=0$	0.536 (4, 124)	-0.008 (-0.141)
Coefficients on lagged $PRESSURE_{cap}$ $^{d}=0$	1.491 (4, 124)	0.019 (0.901)
Coefficients on lagged $PRESSURE_{all}$ $^{e}=0$	0.950 (4,124)	0.010 (0.456)

Model 8: Causal Priority From DBKCAP to PRESSURE

Granger Test: Null Hypothesis	F test (D.F.)	$\sum_{j=1}^{4} f_j$ (t-stat)
Coefficients on lagged DBKCAP = 0 (PRESSURE = $PRESSURE_{unadj}$)	2.22 (4, 124)	1.417 (1.853)
Coefficients on lagged DBKCAP = 0 (PRESSURE = $PRESSURE_{cap}$)	3.141* (4, 124)	3.137 (0.979)
Coefficients on lagged DBKCAP = 0 (PRESSURE = $PRESSURE_{all}$)	3.190* (4,124)	2.969 (1.133)

TABLE 11--continued

* indicates significance level of 5% or greater (two-tailed).

** indicates significance level of 1% or greater (two-tailed).

[a] DBKCAP = $\ln(BKCAP_t/BKCAP_{t-1})$, where $BKCAP_t$ is the primary book capital ratio at quarter t.

[b] $PRESSURE_{dum}$ = 0, if the capital rating improves to a 1 or stays at a 1, and $PRESSURE_{dum}$ = 1, if the capital rating declines to a 3, 4, or 5, or stays at a 3, 4, or 5.

[c] $PRESSURE_{unadj} = (-1*CAPRATE_t) - (-1*CAPRATE_{t-1})$, where CAPRATE is the capital adequacy rating for quarter t.

[d] $PRESSURE_{cap} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1})) * CAPRATE_{t-1}$.

[e] $PRESSURE_{all} = ((-1*CAPRATE_t) - (-1*CAPRATE_{t-1})) * OVERALL_{t-1}$, where OVERALL is the quarterly overall CAMEL rating.

Test of Differential Response Hypothesis. In Chapter 2, I propose a Chow test to determine if large banks are behaving differently from the small banks in the sample. I observe regulatory influence on small banks (either definition) only when I measure regulatory pressure as $PRESSURE_{dum}$. Yet, the differential response hypothesis is untestable for this measure of regulatory pressure because for the large banks, I cannot estimate the model based on $PRESSURE_{dum}$.

Using the remaining measures of PRESSURE, I am unable to reject the null hypothesis of no causal priority between PRESSURE and changes in book capital ratios for either definition of large or small bank. So, tests of the differential response hypothesis are not warranted.

Econometric Issues. Before concluding this chapter, I address several econometric issues that arise in the estimation of models 7 and 8. This is necessary to lend credibility to my Granger results.

First, by pooling cross-sections and time series, I may have heteroscedastic or serially correlated residuals. I do not find evidence of either. To test for serially correlated residuals, I perform the Box-Pierce Q statistic on the 7 residuals generated in each cross-section. The Box-Pierce Q statistic is

$$Q_i = T\sum_{s=1}^{k} r_{is}^2,$$

The r_{is} is the correlation of the residuals at lag s for bank i. T is the number of observations, 7. The degrees of freedom are k, which I set to 6 for all banks. The Q-stat is a test of the null hypothesis that the correlations up to lag k are all equal to zero. I am unable to reject the null hypothesis for the residuals from models 7 and 8 (full sample) with PRESSURE defined as $PRESSURE_{unadj}$ or $PRESSURE_{cap}$.[13]

To test for heteroscedasticity, I perform the Goldfield-Quant test. Heteroscedastic errors may arise because banks of varying size compose the sample. So, I order the sample in terms of average assets over the 1984-1986 period. I then estimate the model for the 19 smallest banks and the 20 largest banks. I compare the residual sums of squares of the two groups and find no significant difference. I later confirm this result by acknowledging the similarity of the Granger tests results across the two groups.[14]

Another issue about pooled regressions is that of time-varying and individual-varying parameters. To provide the

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[13] By structuring the Q-stat in this manner, I am assuming that any serial correlation is the result of time and not the cross-sections. This is why I did not feel compelled to perform these tests on (1) models based on the largest and smallest banks, or (2) the other measures of regulatory pressure.

[14] This test should be carried out on a sample that is ordered by one of the independent variables thought to be generating the heteroscedastic errors. I am unable to carry out the test in this way because of the lag structure of the model. Ordering the sample by an independent variable would corrupt the cross-sections and create an inaccurate lag structure.

estimates in Table 9, I constrain the coefficients to be equal across all the banks and across all 12 quarters. I check the validity of this assumption by performing one factor analysis of variance tests on the residuals from models 7 and 8 (full sample). Analysis of variance with individuals as the factor does not suggest that constant coefficients across banks are inappropriate. Yet, a similar test with time as the factor does suggest that time-varying parameters are more appropriate.

I then use fixed effects estimation where I transform the original data series, DBKCAP and $PRESSURE_{unadj}$ (or $PRESSURE_{cap}$), by subtracting the mean of the observations for each quarter. Restimating the models 7 and 8 (full sample) with the transformed data does not produce conclusions that differed from the ones reported in Table 9.

Finally, I check to see if the residuals from the models that I describe in Tables 9, 10, and 11 are normal. As described in Judge, et al., the presence of non-normal disturbances can invalidate F and t tests of the coefficients. Both tests are crucial to my analysis.

In Table 12, I report Shapiro-Wilk statistics that I base on the residuals from models 7 and 8 (full sample, largest 20 banks, and smallest 19 banks). The null hypothesis is that the disturbances are normally distributed. Small statistics are likely to lead to a rejection of the null hypothesis. I also

TABLE 12
SHAPIRO-WILK TESTS OF NORMALITY
AND TESTS OF SKEWNESS AND KURTOSIS:
RESIDUALS FROM MODELS 7 AND 6

Sample	Full	Full	Largest	Largest	Smallest	Smallest
Dep.Var	DBKCAP	$PRESSURE_{unadj}$	DBKCAP	$PRESSURE_{unadj}$	DBKCAP	$PRESSURE_{unadj}$
SW Stat.	0.905	0.474	0.982	0.480	0.839	0.618
p<SW	0.0	0.0	0.5271	0.0	0.0	0.0
Kurtosis	11.105*	20.65*	1.027*	21.94*	10.06*	18.63*
Skewness	1.604*	2.36*	-0.311	2.58*	2.12*	2.32*

Sample	Full	Full	Largest	Largest	Smallest	Smallest
Dep.Var	DBKCAP	$PRESSURE_{cap}$	DBKCAP	$PRESSURE_{cap}$	DBKCAP	$PRESSURE_{cap}$
SW Stat.	0.901	0.426	0.982	0.497	0.815	0.504
p<SW	0.0	0.0	0.581	0.0	0.0	0.0
Kurtosis	11.67*	87.54*	1.166	25.46*	11.87*	62.19*
Skewness	1.66*	7.32*	-0.308	3.134*	2.36*	6.72*

** indicates that I can reject the null hypothesis that kurtosis or skewness is equal to zero at the 1% level.

report indicators of skewness and kurtosis. If a distribution is normal, then both should be insignificantly different from zero.

The statistics show only one residual series that is normal. These residuals are from an estimate of model 7 (dependent variable equals DBKCAP) for the largest sample banks. All other residual series appear non-normal.[15] Those residual series based on $PRESSURE_{unadj}$ or $PRESSURE_{cap}$ as the dependent variable have consistently smaller Shapiro-Wilkes statistics and larger measures of skewness and kurtosis than series based on DBKCAP as the dependent variable. Further, measures of kurtosis and skewness in the lower box in Table 12 are larger than their counterparts in the upper box. This is possibly the result of the asymmetry of $PRESSURE_{cap}$ exacerbating the non-normality of $PRESSURE_{unadj}$.[16]

To deal with the non-normality of the residuals, I can (1) assume that the F and t-tests are asymptotically justified, or (2) transform the capital rating series so that it is normally distributed. My current choice is (1). I have

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[15] The conclusions about normality of residuals do not change if I define large banks as the 11 TBTF banks and small banks as the remaining 47 banks in the sample.

[16] $PRESSURE_{cap}$ measures regulatory pressure asymmetrically in the following way. As I have defined the measure, a decrease in rating from 2 to 3 is -2 ((-3 - (-2))*2). Yet an increase in rating from a 3 to 2 is not 2; it is 3 ((-2 - (-3))*3).

based the discussion and conclusions on this assumption. The decision to opt for (2) depends on how likely a transformation of the capital rating series will reveal results that non-normal residuals are currently obscuring.

Conclusion. I conclude this chapter by noting the following. When I measure regulatory pressure as a dichotomous variable that uses changes and levels of the capital rating, I consistently find effective regulation of book capital ratios at all but the largest 20 or larger 11 banks in the sample. I first derive this conclusion from the means tests; the Granger causality test that measures regulatory pressure as $PRESSURE_{dum}$ strengthens this result.

There is no evidence that each level of the capital adequacy rating or the overall CAMEL rating represents an effective degree of regulatory pressure. I better capture regulatory pressure by aggregating levels of capital rating to distinguish banks subject to possible sanctions and more intrusive supervision.

Yet, when the largest 20 (or larger 11) banks have weak capital positions, the threat of continued scrutiny by regulators does not seem to represent a cost significant enough to warrant recapitalization. This finding is consistent with conclusions from prior studies of banks that generally support the capture theory of economic regulation. Further, the finding of ineffective capital regulation that is based on

the 11 TBTF banks is consistent with O'Hara and Shaw (1990) result that this implied designation produces a wealth transfer to the TBTF banks from the "too small to save" banks.

CHAPTER 4
CAPITAL REGULATION AND BALANCE SHEET CHANGES

Background

Keeley (1988) examines capital-related balance sheet changes following the 1981 regime shift because he finds that regulatory control of capital apparently increased. Logically, he should ask if the capital-deficient banks responded to regulatory demands with **authentic** changes in capital. There are potential gimmicks (such as increasing standby letters of credit) that allow management to window-dress book capital. Because these gimmicks exist, a result supporting effective control of capital is not conclusive until there is a check for window-dressing.

In Chapter 2, I conclude that capital regulation is effective at the smallest 19 banks in the sample.[1] This conclusion is confirmed by the Granger tests of causality and means tests that separate banks under much regulatory pressure from banks under little regulatory pressure. So, like Keeley, I replicate these tests for specific capital-related balance sheet items.

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[1] I also find effective capital regulation when I define small banks as being all but the 11 TBTF banks in the sample.

I define authentic capital-related balance sheet changes as

1. changes in income before extraordinary items;
2. changes in lead bank assets;
3. changes in common shares outstanding;
4. changes in the payout ratio (total dividends declared/total income before extraordinary items), and
5. changes in loan loss reserves.

As Keeley, I look at changes in standby letters of credit as a method for window-dressing capital.

Since I do not find that capital regulation is effective for the largest 20 banks (or the larger 11 banks), I do not examine changes in specific capital-related balance sheet items for this subset. Regulators perhaps control aspects of capital that the examination of capital ratios obscures. Yet, uncovering these items does not seem necessary if I know ex ante that the net effect of this regulation is nil.

For this analysis, I also forgo a discussion of Granger test results that use the alternate measures of regulatory pressure, $PRESSURE_{unadj}$, $PRESSURE_{cap}$, and $PRESSURE_{all}$. In Chapter 3, I conclude that the these measures do not capture well the effectiveness of regulatory pressure. I perform these tests on changes in capital-related balance sheet items, and I reach the same conclusion.[2]

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[2] There is one exception. Using measures $PRESSURE_{unadj}$ and $PRESSURE_{all}$, I reject the null hypothesis that prior changes in pressure are not causally prior to changes in loan loss reserves. The sums of the lagged coefficients of $PRESSURE_{unadj}$

While these tests do not detect the causal relationship running from regulatory pressure to capital-related balance sheet changes, they are useful in detecting causal priority of balance sheet changes. I find that for either definition of a small bank, prior increases in provision for loan losses lead to decreases in regulatory pressure. Tests of the smallest 19 banks also show that prior declines in dividend payout lead to a decrease in regulatory pressure.[3] These are the only indications of changes in capital-related balance sheet items leading to changes in regulatory pressure.

Means Tests and Granger Tests of the Issue

Means tests: smallest 19 banks. In Table 8 in Chapter 3, I show that for the smallest 19 banks in the sample, banks that fall or remain at a capital rating of 3 or worse ($BANKS_{much}$) have significantly greater growth in book capital ratios than banks that improve or remain at a rating of 1 ($BANKS_{little}$). So, for the smallest 19 banks in the sample, I repeat the $BANKS_{much}$ versus $BANKS_{little}$ analyses that I base on specific capital-related balance sheet changes. I report the results in Tables 13 through 18.

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and $PRESSURE_{all}$ are significantly less than zero at the 5% level. This is consistent with declines in ratings preceding increases in provision for loan losses. This is true when I define the small banks as the smallest one-third of the sample or the smaller 47 banks.

[3] This result is found only when I define small banks as the smallest one-third in the sample.

TABLE 13
MEAN CUMULATIVE GROWTH IN ASSETS:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
SMALLEST 19 BANKS

	QT_{t+1}[a]	QT_{t+2}[b]	QT_{t+3}[c]	QT_{t+4}[d]	QT_{t+5}[e]
(A) Banks Under Much Regulatory Pressure[g]	0.013 (0.100)[f] n=32	0.018 (0.101) n=28	0.029 (0.121) n=23	0.031 (0.124) n=18	0.026 (0.135) n=15
(B) Banks Under Little Regulatory Pressure[h]	0.057 (0.131) n=81	0.114 (0.186) n=72	0.173 (0.250) n=63	0.230 (0.289) n=54	0.282 (0.348) n=46
(A) - (B)	-0.044	-0.096	-0.144	-0.199	-0.256
t-stat[i] (d.f)	-1.73 (111)	-2.57* (98)	-2.65** (84)	-2.82** (70)	-2.78** (59)

** significant at 1% level (two-tailed test).

* significant at 5% level (two-tailed test).

a Cumulative growth rate at $QT_{t+1} = \ln(ASSETS_{t+1}/ASSETS_t)$, where ASSETS is the total book value of the assets of the lead bank.

b Cumulative growth rate at $QT_{t+2} = \ln(ASSETS_{t+2}/ASSETS_t)$.

c Cumulative growth rate at $QT_{t+3} = \ln(ASSETS_{t+3}/ASSETS_t)$.

d Cumulative growth rate at $QT_{t+4} = \ln(ASSETS_{t+4}/ASSETS_t)$.

e Cumulative growth rate at $QT_{t+5} = \ln(ASSETS_{t+5}/ASSETS_t)$.

f Standard deviation.

g These banks experienced (at quarter t) a decline in rating to a 3, 4, or 5 or experienced no change in rating from a 3, 4, or 5.

h These banks experienced (at quarter t) an increase in rating to a 1 or experienced for change in rating from a 1.

i These statistics are based on equal variances. Statistics based on unequal variances (when applicable) attain comparable significance levels.

TABLE 14
MEAN CUMULATIVE GROWTH IN PAYOUT RATIO:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
SMALLEST 19 BANKS

	QT_{t+1}[a]	QT_{t+2}[b]	QT_{t+3}[c]	QT_{t+4}[d]	QT_{t+5}[e]
(A) Banks Under Much Regulatory Pressure[g]	-0.163 (0.518)[f] n=16	-0.292 (0.595) n=14	-0.243 (0.682) n=13	-0.189 (0.785) n=8	-0.201 (0.819) n=9
(B) Banks Under Little Regulatory Pressure[h]	-0.018 (0.223) n=66	-0.017 (0.435) n=59	-0.022 (0.467) n=51	-0.065 (0.290) n=43	-0.042 (0.297) n=37
(A) - (B)	-0.145	-0.275	-0.265	0.254	-0.243
t-stat[i] (d.f)	-1.73 (80)	-1.98 (71)	-1.38 (62)	-0.84 (51)	-0.97 (44)

[a] Cumulative growth rate at QT_{t+1} = ($PAYOUT_{t+1}$-$PAYOUT_t$)/$PAYOUT_t$, where PAYOUT is the quarterly payout ratio.

[b] Cumulative growth rate at QT_{t+2} = ($PAYOUT_{t+2}$-$PAYOUT_t$)/$PAYOUT_t$.

[c] Cumulative growth rate at QT_{t+3} = ($PAYOUT_{t+3}$-$PAYOUT_t$)/$PAYOUT_t$.

[d] Cumulative growth rate at QT_{t+4} = ($PAYOUT_{t+4}$-$PAYOUT_t$)/$PAYOUT_t$.

[e] Cumulative growth rate at QT_{t+5} = ($PAYOUT_{t+5}$-$PAYOUT_t$)/$PAYOUT_t$.

[f] Standard deviation.

[g] These banks experienced (at quarter t) a decline in rating to a 3, 4, or 5 or experienced no change in rating from a 3, 4, or 5.

[h] These banks experienced (at quarter t) an increase in rating to a 1 or experienced for change in rating from a 1.

[i] These statistics are based on equal variances. Statistics based on unequal variances (when applicable) attain comparable significance levels.

TABLE 15
MEAN CUMULATIVE GROWTH IN COMMON SHARES OUTSTANDING:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
SMALLEST 19 BANKS

	QT_{t+1} [a]	QT_{t+2} [b]	QT_{t+3} [c]	QT_{t+4} [d]	QT_{t+5} [e]
(A) Banks Under Much Regulatory Pressure[h]	0.077 (0.303)[f] n=32	0.177 (0.444) n=28	0.316 (0.571) n=23	0.506 (0.699) n=18	0.605 (0.755) n=15
(B) Banks Under Little Regulatory Pressure[h]	0.054 (0.150) n=81	0.129 (0.228) n=72	0.216 (0.276) n=63	0.278 (0.298) n=54	0.315 (0.309) n=46
(A) - (B)	0.023	0.048	0.100	0.228	0.290
t-stat[i] (d.f)	0.54 (111)	0.71 (98)	1.09 (84)	1.93 (70)	2.14* (59)

* significant at 5% level (two-tailed test).

[a] Cumulative growth rate at $QT_{t+1} = \ln(SHOUT_{t+1}/SHOUT_t)$, where SHOUT is the common shares outstanding.

[b] Cumulative growth rate at $QT_{t+2} = \ln(SHOUT_{t+2}/SHOUT_t)$.

[c] Cumulative growth rate at $QT_{t+3} = \ln(SHOUT_{t+3}/SHOUT_t)$.

[d] Cumulative growth rate at $QT_{t+4} = \ln(SHOUT_{t+4}/SHOUT_t)$.

[e] Cumulative growth rate at $QT_{t+5} = \ln(SHOUT_{t+5}/SHOUT_t)$.

[f] Standard deviation.

[h] These banks experienced (at quarter t) a decline in rating to a 3, 4, or 5 or experienced no change in rating from a 3, 4, or 5.

[h] These banks experienced (at quarter t) an increase in rating to a 1 or experienced for change in rating from a 1.

[i] These statistics are based on equal variances. Statistics based on unequal variances (when applicable) attain comparable significance levels, except quarters t+4 and t+4. The t-stats fall to 1.34 and 1.45, respectively.

TABLE 16
MEAN CUMULATIVE GROWTH IN INCOME
BEFORE EXTRAORDINARY ITEMS:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
SMALLEST 19 BANKS

	QT_{t+1}[a]	QT_{t+2}[b]	QT_{t+3}[c]	QT_{t+4}[d]	QT_{t+5}[e]
(A) Banks Under Much Regulatory Pressure[g]	-1.049 (4.193)[f] n=32	0.124 (1.583) n=28	0.086 (0.984) n=23	0.182 (1.101) n=18	-0.082 (0.833) n=15
(B) Banks Under Little Regulatory Pressure[h]	0.040 (0.134) n=71	0.070 (0.164) n=63	0.121 (0.215) n=55	0.172 (0.162) n=47	0.212 (0.227) n=40
(A) - (B)	-1.089	0.054	-0.035	0.010	-0.294
t-stat[i] (d.f)	-2.20* (101)	0.27 (89)	-0.25 (76)	0.06 (63)	-2.06* (53)

* significant at the 5% level (two-tailed test).

[a] Cumulative growth rate at QT_{t+1} = $(INCOME_{t+1} - INCOME_t)/INCOME_t$, where INCOME is quarterly income before extraordinary items.

[b] Cumulative growth rate at QT_{t+2} = $(INCOME_{t+2} - INCOME_t)/INCOME_t$.

[c] Cumulative growth rate at QT_{t+3} = $(INCOME_{t+3} - INCOME_t)/INCOME_t$.

[d] Cumulative growth rate at QT_{t+4} = $(INCOME_{t+4} - INCOME_t)/INCOME_t$.

[e] Cumulative growth rate at QT_{t+5} = $(INCOME_{t+5} - INCOME_t)/INCOME_t$.

[f] Standard deviation.

[g] These banks experienced (at quarter t) a decline in rating to a 3, 4, or 5 or experienced no change in rating from a 3, 4, or 5.

[h] These banks experienced (at quarter t) an increase in rating to a 1 or experienced for change in rating from a 1.

TABLE 16--continued

These statistics are based on equal variances. Statistics based on unequal variances (when applicable) attain comparable significance levels.

TABLE 17
MEAN CUMULATIVE GROWTH IN TOTAL STANDBY LETTERS OF CREDIT:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
SMALLEST 19 BANKS

	QT_{t+1}[a]	QT_{t+2}[b]	QT_{t+3}[c]	QT_{t+4}[d]	QT_{t+5}[e]
(A) Banks Under Much Regulatory Pressure[g]	-0.060 (0.270)[f] n=32	-0.128 (0.377) n=28	-0.214 (0.407) n=23	-0.257 (0.481) n=18	-0.385 (0.473) n=15
(B) Banks Under Little Regulatory Pressure[h]	0.064 (0.382) n=80	0.108 (0.545) n=71	0.144 (0.668) n=62	0.153 (0.632) n=53	0.166 (0.604) n=45
(A) - (B)	-0.124	-0.236	-0.358	-0.410	-0.551
t-stat[i] (d.f)	-1.68 (110)	-2.10* (97)	-2.40* (83)	-2.52* (69)	-3.22** (58)

** significant at the 1% level (two-tailed test).

* significant at the 5% level (two-tailed test).

a Cumulative growth rate at $QT_{t+1} = \ln(TSBL_{t+1}/TSBL_t)$, where TSBL is the total standby letters of credit outstanding.

b Cumulative growth rate at $QT_{t+2} = \ln(TSBL_{t+2}/TSBL_t)$.

c Cumulative growth rate at $QT_{t+3} = \ln(TSBL_{t+3}/TSBL_t)$.

d Cumulative growth rate at $QT_{t+4} = \ln(TSBL_{t+4}/TSBL_t)$.

e Cumulative growth rate at $QT_{t+5} = \ln(TSBL_{t+5}/TSBL_t)$.

f Standard deviation.

g These banks experienced (at quarter t) a decline in rating to a 3, 4, or 5 or experienced no change in rating from a 3, 4, or 5.

h These banks experienced (at quarter t) an increase in rating to a 1 or experienced for change in rating from a 1.

i These statistics are based on equal variances. Statistics based on unequal variances (when applicable) attain comparable significance levels.

TABLE 18
MEAN CUMULATIVE GROWTH IN RESERVE FOR LOAN LOSSES:
BANKS UNDER MUCH REGULATORY PRESSURE
VS.
BANKS UNDER LITTLE REGULATORY PRESSURE
SMALLEST 19 BANKS

	QT_{t+1} [a]	QT_{t+2} [b]	QT_{t+3} [c]	QT_{t+4} [d]	QT_{t+5} [e]
(A) Banks Under Much Regulatory Pressure[g]	0.005 (0.012)[f] n=32	0.008 (0.013) n=28	0.012 (0.013) n=23	0.012 (0.005) n=18	0.014 (0.006) n=15
(B) Banks Under Little Regulatory Pressure[h]	0.002 (0.001) n=81	0.003 (0.001) n=72	0.005 (0.002) n=63	0.007 (0.002) n=54	0.009 (0.003) n=46
(A) - (B)	0.003	0.005	0.007	0.005	0.005
t-stat[i] (d.f)	2.86** (111)	3.35** (98)	3.88** (84)	5.32** (70)	4.95** (59)

** significant at 1% level (two-tailed test).

* significant at 5% level (two-tailed test).

[a] Cumulative growth rate at $QT_{t+1} = PROVIS_{t+1}$, where PROVIS is the ratio of the quarterly provision for loan losses to the average loan outstanding over the 1984Q1-1986Q4 period.

[b] Cumulative growth rate at $QT_{t+2} = PROVIS_{t+2} + PROVIS_{t+1}$.

[c] Cumulative growth rate at $QT_{t+3} = PROVIS_{t+3} + PROVIS_{t+2} + PROVIS_{t+1}$.

[d] Cumulative growth rate at $QT_{t+4} = PROVIS_{t+4} + PROVIS_{t+3} + PROVIS_{t+2} + PROVIS_{t+1}$.

[e] Cumulative growth rate at $QT_{t+5} = PROVIS_{t+5} + PROVIS_{t+4} + PROVIS_{t+3} + PROVIS_{t+2} + PROVIS_{t+1}$.

[f] Standard deviation.

[g] These banks experienced (at quarter t) a decline in rating to a 3, 4, or 5 or experienced no change in rating from a 3, 4, or 5.

[h] These banks experienced (at quarter t) an increase in rating to a 1 or experienced for change in rating from a 1.

TABLE 18--continued

[i] These statistics are based on equal variances. Statistics based on unequal variances (when applicable) attain comparable significance levels, except quarters t+1, t+3, and t+3. For these quarters, the t-statistics drop to -1.79, -2.10 (significant at 5%), and -2.37 (significant 5%), respectively.

The test results in Tables 13 through 18 suggest that the smallest banks in the sample respond to regulatory pressure by slowing growth in assets, adding to loan loss reserves, and shrinking standby letters of credit.[4] Further, two of the $BANKS_{much}$ suspend dividends after the rating falls to a 3; one of the $BANKS_{much}$ pays no dividends for the 12 quarter period.

Granger tests of causality. I use Granger tests of causality to examine the robustness of the means test results. I control for the impact of past changes in assets, loan loss reserves, and standby letters of credit on the current change in these variables. To perform this test, I measure regulatory pressure as $PRESSURE_{dum}$, which is a dummy variable that equals 1 if $BANKS_{much}$ and 0 if $BANKS_{little}$.

The null hypothesis, H01, is $PRESSURE_{dum}$ is not causally prior to ACT, where ACT is

1. $DASSETS = \ln(ASSETS_t/ASSETS_{t-1})$, where ASSETS is the total book value of lead bank assets at quarter t;

2. $DSLC = \ln(SLC_t/SLC_{t-1})$, where SLC is the total (domestic and foreign) standby letters of credit outstanding at quarter t, and

3. $PROVIS = PROVIS_t/AVGLNLS$, where PROVIS is the provision for loan losses at quarter t and AVGLNLS is the average loan and lease portfolio over the 12 quarters in the 1984-1986 period.

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[4] When I define small banks as all but the 11 TBTF banks in the sample, I produce essentially the same results. The only substantial difference arises when examining standby letters of credit. This sample of small banks fails to create significant differences in growth at quarters t+2 and t+4.

To test H01, I estimate restricted and unrestricted versions of model 9.

$$ACT_{it} = \alpha_2 + \sum_{j=1}^{4} a_j ACT_{i(t-j)} + \sum_{j=1}^{4} b_j PRESSURE_{dum(i(t-j))} + \psi_{t2} \quad (9)$$

In Table 19, I report the results of tests of model 9 for the smallest 19 banks in the sample. I also include the sum of the coefficients of lagged $PRESSURE_{dum}$ and a t-statistic for the test of the null hypothesis that the sum is not significant from zero.

Including prior changes in regulatory pressure improves the estimate of the current change in total standby letters of credit and loan loss reserves. Increases in regulatory pressure reduce standby letters of credit and increase the loan loss reserves. Changes in regulatory pressure do not improve the estimate of the current change in lead bank assets.[5]

Conclusion. My purpose for examining capital-related balance sheet changes at small banks is to decide if regulatory pressure leads to authentic changes in capital. I find that improvements in capital are linked to increases in

[5] The conclusions from the Granger tests are the same when I define small banks as all but the 11 TBTF banks in the sample.

TABLE 19
GRANGER TEST RESULTS FOR THE RELATIONSHIP BETWEEN CHANGES IN REGULATORY PRESSURE AND (1) CHANGES IN ASSETS, (2) CHANGES IN STANDBY LETTERS OF CREDIT, AND (3) CHANGES IN RESERVES FOR LOAN LOSSES: SMALLEST 19 BANKS

Dep. Var.	Granger Test Null Hypothesis[a]	F test (d.f)	$\sum_{j=1}^{4} b_j$ (t-stat)
DASSET[b]	$b_1=b_2=b_3=b_4=0$	0.8083 (4,57)	-0.018 (-0.593)
DTSBL[c]	$b_1=b_2=b_3=b_4=0$	3.0692* (4,55)	-0.187 (-1.989)*
PROVIS[d]	$b_1=b_2=b_3=b_4=0$	3.4033* (4,57)	0.0009 (2.917)**

** significant at the 1% level.

* significant at the 5% level.

a The measure of regulatory pressure is $PRESSURE_{dum}$, which is 1 if $BANKS_{much}$ and 0 if $BANKS_{little}$.

b DASSETS = $\ln(ASSETS_t/ASSETS_{t-1})$, where ASSETS is the total book value of lead bank assets.

c DSLC = $\ln(SLC_t/SLC_{t-1})$, where SLC is the total (domestic and foreign) standby letters of credit outstanding.

d PROVIS = $PROVIS_t/AVGLNLS$, where PROVIS is the provision for loan losses, and AVGLNLS is the average loan and lease portfolio over the 12 quarters in the 1984-1986 period.

loan loss reserves. There is anecdotal evidence that suggests that increases in regulatory pressure precede suspension of dividend payments. Finally, I find no evidence that suggests banks under regulatory pressure are using standby letters of credit to window-dress their capital ratios. This observation has implications for the regulation of market capital. Since the changes in book capital appear to be authentic, then effective regulation of book capital implies the effective regulation of market capital as well.

CHAPTER 5
CAPITAL REGULATION AND RISK

Background

One would assume that a bank, forced by regulators to meet capital requirements, would lower its chance of insolvency. Possibly confounding the seemingly straightforward relationship between capital requirements and insolvency are changes in asset risk that may accompany recapitalization.

The predictions of models by Koehn and Santomero (1980) and by Furlong and Keeley (1987) exemplify divergent views on capital regulation as a curb on bankruptcy. Both models make the assumption that regulators are effective in controlling market capital.

Koehn and Santomero (1980) predict that a previously unconstrained bank, following the imposition of binding capital requirements, **may** opt for a riskier portfolio. This shift to the riskier portfolio can increase the bank's probability of insolvency.

Furlong and Keeley (1987) predict that binding capital requirements **unambiguously** reduce the risk of bankruptcy. This prediction requires the assumption that regulators not substitute capital requirements for examination/supervision.

Furlong and Keeley (1990) argue that the Koehn and Santomero (1980) ambiguous prediction is untenable. They observe that the Koehn and Santomero model, which does not allow for bankruptcy, is inappropriate for examining the effect of capital regulation on the likelihood of bankruptcy. The uninsured banks in Koehn and Santomero's model cannot fail because the assumed non-stochastic deposit costs imply that asset returns are always sufficient to meet depositors' claims. Risk-free borrowing leads to a linear relationship between expected asset returns and asset risk. The linear relationship is necessary for Koehn and Santomero's prediction that previously unconstrained banks may choose riskier portfolios following the imposition of capital requirements. Since a linear characterization of risk and return is not applicable to insured or uninsured banks that can fail, this prediction has little merit.

In Furlong and Keeley (1987), all deposits are 100% insured at no cost to banks. This insurance scheme results in deposit costs that are not fixed as in Koehn and Santomero, but vary indirectly with the value of the insurance subsidy. Left unconstrained, a bank will pursue maximum leverage and asset risk to maximize the value of the insurance subsidy, and

achieve the lowest possible expected deposit cost.[1] So, bank owners will risk bankruptcy.

Binding capital requirements cannot encourage risk-taking behavior in Furlong and Keeley's model. This follows from their result that marginal increases in asset risk produce greater subsidy value at higher levels of leverage. So, if regulators impose binding capital requirements, banks will not choose riskier portfolios since regulators do not diminish the intensity of examination/supervision. The probability of bankruptcy is unambiguously less as banks diminish leverage to satisfy capital requirements.

An empirical investigation of the issue may verify the appropriateness of the Furlong and Keeley prediction versus that of Koehn and Santomero. Furlong (1988) uses the Keeley (1988) capital-deficient/sufficient dichotomy to conclude that the December 1981 capital standards did not cause banks to increase asset risk. Although the capital-deficient and sufficient banks increased asset risk during 1981-1986, the average increase across the two groups was not significantly different. This result is consistent with the prediction from Furlong and Keeley's model.

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[1] From the depositors' perspective, the insured deposits are risk-free so the return does not vary with leverage or asset risk.

Both models and the empirical study base predictions or conclusions on a single, exogenous change in capital requirements. Flannery (1989) suggests two conditions that are necessary and sufficient for capital regulation to lower the risk of bankruptcy in a multi-period setting. First, regulators, by examining the bank, must tie the change in the capital requirement to changes in asset risk. So, the changes in capital requirements cannot be entirely exogenous. Second, regulators must effectively control real capital. If regulators meet both conditions, bankers will eschew risk-shifting. They will anticipate settling up with regulators (in terms of higher capital requirements) in the next examination period.

Duan, Moreau, and Seeley (1990) examine whether regulators tie permissible leverage to asset risk. They test the null hypothesis that asset risk is not negatively correlated with leverage ratios. They define the leverage ratio as the market value of equity divided by the market value of assets. Using an option pricing framework, they develop estimates of asset risk and the market value of total assets. For 33 of the 35 banks in their sample, they reject the null hypothesis.

Duan et al. interpret the negative concurrent relationship between asset risk and the leverage ratio as regulators lowering the level of permissible leverage as banks

increase asset risk. I question their interpretation the results. Their finding of negative correlation between asset risk and leverage could result because the uninsured deposit markets, not regulators, are exerting discipline on banks. Without capturing regulatory influence in the model, Duan et al. cannot unambiguously attribute the negative correlation to regulators.[2]

My conclusions from Chapter 3 and 4 provide me with an experiment for examining the relationship between capital regulation and risk. There is evidence that the small banks are driving the conclusion that regulators influence capital ratios at the full sample of banks. Further, Chapter 4 suggests that these capital changes are genuine. So, I expect that at the smaller banks, increases in regulatory pressure will cause at most a drop in asset risk, and at least no change in asset risk. If asset risk increases after an increase in regulatory pressure, I would expect to find regulators failing to tie the determination of capital adequacy to risk.

For the large banks in the sample, I do not observe effective capital regulation. Even the threat of heighten

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[2] Duan, et al. examine 1976-1986; I look at 1984-1986. Their inclusion of the pre-1981 period increases my doubt about their interpretation of their results. As I mention in Chapter 2, studies of capital regulation in this period claim that regulators cannot control capital.

supervision and sanctions does not provide regulators with the leverage necessary to bring large capital inadequate banks into compliance. So these large banks under much regulatory pressure may view additional risk-taking as a positive net present value project.

Means Tests of the Issue

Measures of risk. To examine the relationship between changes in risk and changes in regulatory pressure, I define risk in four ways: asset risk, premia on large certificates of deposit (CDs), the ratio of liquid assets to total assets, and interest rate risk. The first two assess risk from the perspective of the equity markets and uninsured deposit markets. The last two are balance sheet measures of risk.

My measure of asset risk is defined in James (1988). The measure is equal to the product of the variance of equity returns and the square of the ratio of the market value of equity to book value of assets. The measure arises from the following expression for the variance of asset returns:

$$\sigma_A^2=(\frac{D}{A})^2\sigma_D^2+(\frac{E}{A})^2\sigma_E^2+2(\frac{D}{A})(\frac{E}{A})\sigma_{DE},$$

where A, D, and E are the market value of assets, deposits, and equity respectively. To estimate the variance of asset returns, σ_A^2, James assumes that the variance of deposit

returns, σ_D^2, is zero. He bases σ_E^2 on the monthly common stock returns for the 12 months prior to the end of the quarter.

Premia on large CDs are also defined in James (1988). The premium is equal the difference between the quarterly average rate paid on large CDs and the average yield on ninety-day Treasury bills. James estimates the average rate paid on large CDs by dividing the total interest paid during a quarter by the average dollar value of domestic CDs outstanding during the quarter.

The third risk measure relates to a balance sheet measure of risk used in Furlong (1988). Low-risk assets include cash and due from banks, Treasury securities, government agency securities, municipal securities, and other taxable securities at the holding company level.

The last risk measure is defined in James (1988) as the absolute value of the difference between face value of assets subject to repricing within one year and the face value of liabilities subject to repricing within the same period, divided by the book value of lead bank equity. The greater is this value, the greater is the maturity mismatch between bank assets and liabilities. A large maturity mismatch exposes the bank to greater interest rate risk.

Means tests: largest 20 vs. smallest 19 banks. In Figures 5 through 8 (largest 20 banks), I present the mean changes in the risk measures for banks that remain or decline

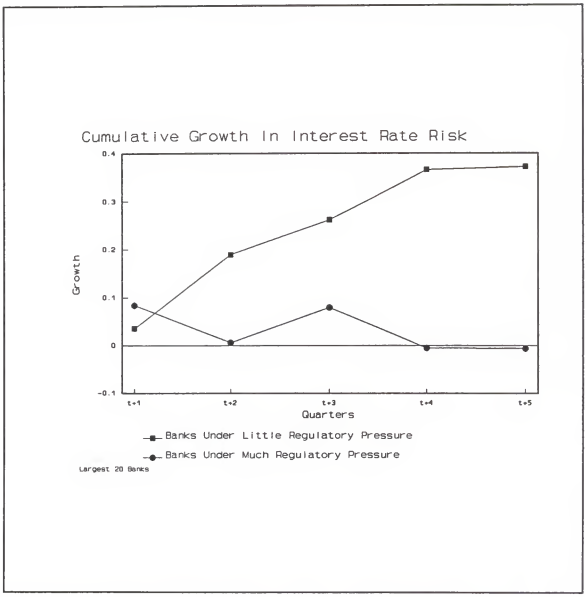

Figure 5: Growth in interest rate risk is measured as ln(interest rate $risk_{t+n}$/interest rate $risk_t$), where n= 1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 38, 35, 33, 30, and 27, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 26, 23, 20, 17, and 14, respectively.

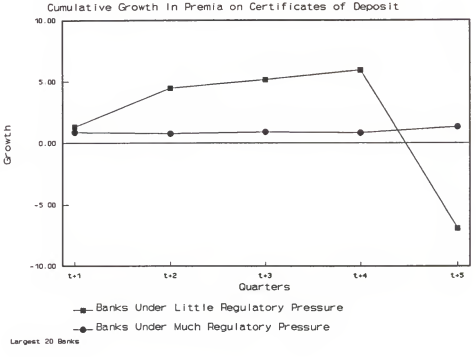

Figure 6: Growth in premium is measured as $(premium_{t+n} - premium_t)/premium_t$, where n=1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 38, 35, 33, 30, and 27, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 26, 23, 20, 17, 14, respectively.

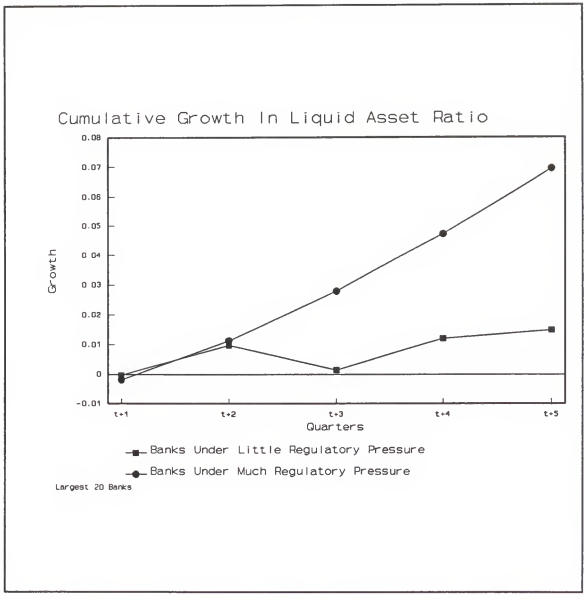

Figure 7: Growth in liquid asset ratio is measured as $\ln(\text{liquid asset ratio}_{t+n}/\text{liquid asset ratio}_{t})$, where n=1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 36, 33, 31, 28, and 25, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 26, 23, 20, 17, and 14, respectively.

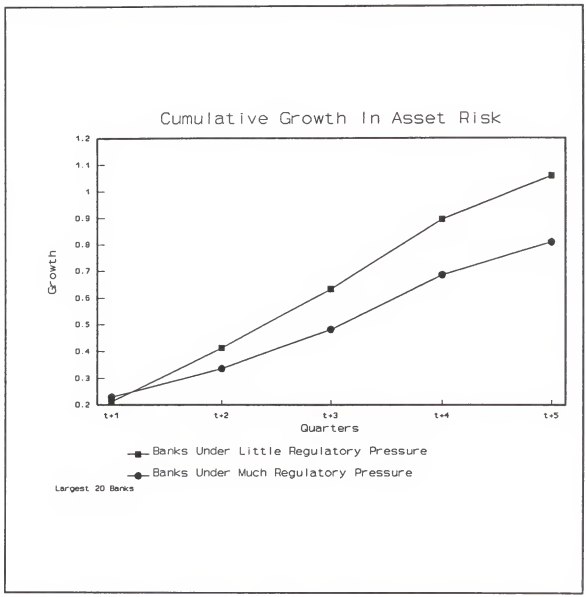

Figure 8: Growth in asset risk is measured as ln(asset $risk_{t+n}$/asset $risk_t$), where n= 1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 38, 35, 33, 30, and 27, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 26, 23, 20, 17, and 14, respectively.

to a 3, 4, or 5 at quarter t, and for banks that improve or remain at a 1 at quarter t. I refer to the first group as $BANKS_{much}$ and the second group as $BANKS_{little}$. In Figures 9 through 12, I depict changes in risk for the smallest 19 banks. In evaluating whether the mean differences are significantly different from zero, I require a significance level of 5% or better. I base the t-statistics on unequal variances when appropriate.

None of the mean differences in Figures 5 through 12 are significantly different from zero.[3] Performing t-tests on the largest bank and the smallest bank samples produces conclusions about risk-taking that are similar to Furlong (1988), who also uses a dichotomous measure of regulatory pressure to evaluate changes in risk. I consistently find that regulatory pressure does not produce significant differences in risk-taking. Yet, the Granger tests, which I report in the next section, do reveal some significant relationships between regulatory pressure and risk-taking.

[3] I reach the same conclusion if I define the large banks as the 11 TBTF banks and the small banks as the remaining 47 in the sample.

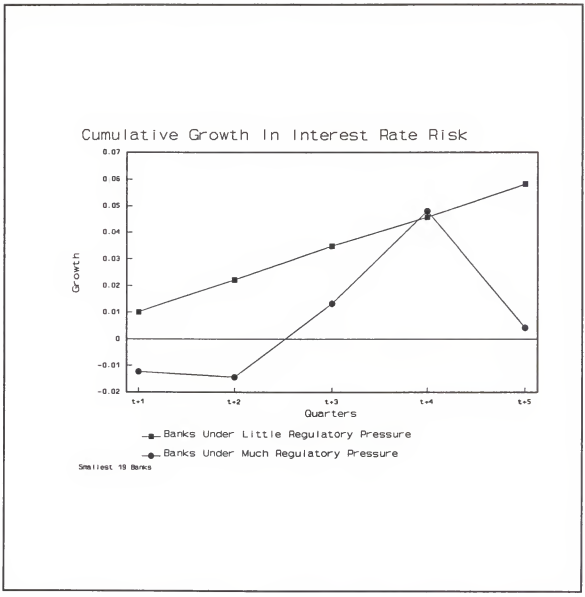

Figure 9: Growth in interest rate risk is measured as ln(interest rate $risk_{t+n}$/interest rate $risk_t$), where n=1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 32, 28, 23, 18, and 15, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 81, 72, 63, 54, and 46, respectively.

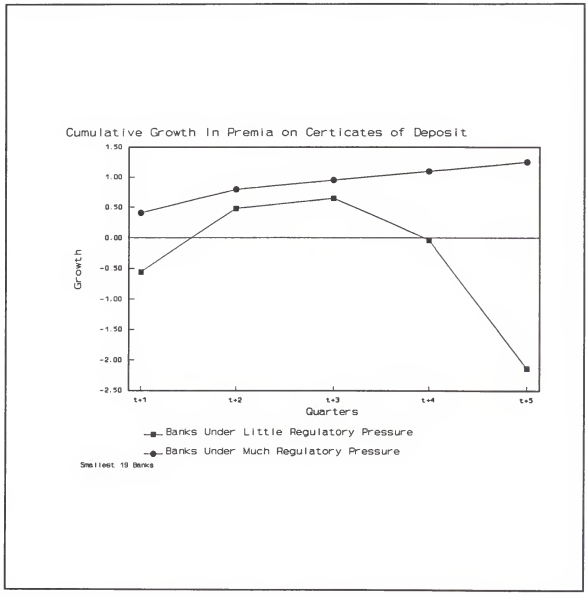

Figure 10: Growth in premium is measured as ($premium_{t+n}$ - $premium_t$)/$premium_t$, where n=1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 32, 28, 23, 18, and 15, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 81, 72, 63, 54, and 46, respectively.

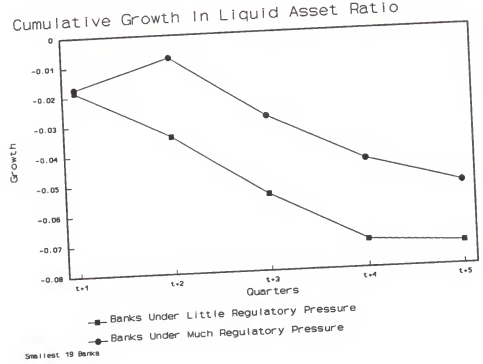

Figure 11: Growth in liquid asset ratio is measured as $\ln(\text{liquid asset ratio}_{t+n}/\text{liquid asset ratio}_{t})$, where n=1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 32, 28, 23, 18, and 15, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 71, 63, 55, 47, and 40, respectively.

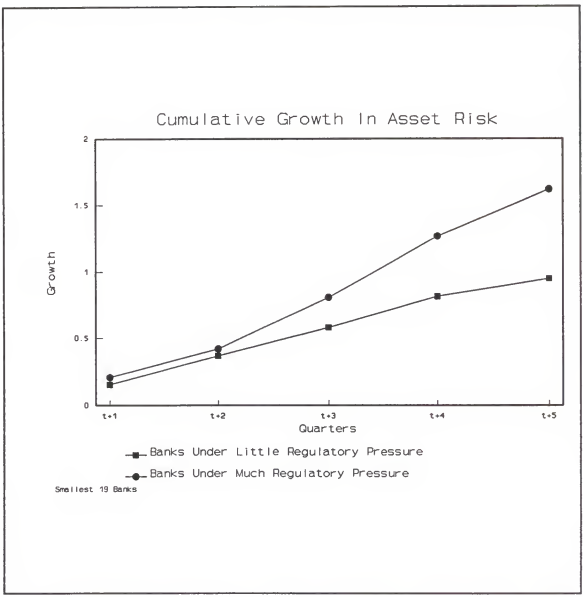

Figure 12: Growth in asset risk is measured as ln(asset $risk_{t+n}$/asset $risk_t$), where n= 1 to 5.

$BANKS_{much}$ observations at t+1 through t+5 are 30, 26, 21, 16, and 13, respectively. $BANKS_{little}$ observations at t+1 through t+5 are 81, 72, 63, 54, and 46, respectively.

Granger Tests of the Issue

Recall that there are four measures of regulatory pressure that I use to test for Granger causality:

1. $PRESSURE_{dum}$, which is a dummy variable equal to 1 if banks remain or decline to a capital rating of 3 or worse, and zero if banks improve or remain at a capital rating of 1;

2. $PRESSURE_{unadj}$, which is the quarterly change in the capital adequacy rating;

3. $PRESSURE_{cap}$, which is $PRESSURE_{unadj}$ times the level of the capital adequacy rating at the beginning of the quarter, and

4. $PRESSURE_{all}$, which is $PRESSURE_{unadj}$ times the level of the overall CAMEL rating at the beginning of the quarter.

I use $PRESSURE_{dum}$ to test the robustness of means tests conclusions that suggest regulators are influencing changes in capital, or capital-related balance sheet items. Means tests in the present context do not suggest that increased regulatory pressure influences risk-taking for any subset of the sample. I verify this by estimating in the model in (10).[4]

$$RISK_{it} = \alpha_3 + \sum_{j=1}^{4} a_j RISK_{i(t-j)} + \sum_{j=1}^{4} b_j PRESSURE_{dum(i(t-j))} + \psi_{t3} \quad (10)$$

RISK refers to any one of the following changes in risk:

[4] This model cannot be estimated for the largest one-third in the sample or the 11 TBTF banks.

1. DVAR, which is the ln(variance of asset returns$_t$/variance of asset returns$_{t-1}$);

2. DSHORT, which is the ln(SHORT$_t$/SHORT$_{t-1}$), where SHORT is the measure of interest rate risk that I defined earlier;

3. DPREM, which is the (premium on CDs$_t$ - premium$_{t-1}$)/premium$_{t-1}$, and

4. DLOWRATIO, which is the ln(liquid asset ratio$_t$/ liquid asset ratio$_{t-1}$).

I cannot reject the null hypothesis that PRESSURE$_{dum}$ is causally prior to any of the RISK variables, except for DLOWRATIO. For the smallest one-third banks in the sample (or the smaller 47 banks), I find that prior PRESSURE$_{dum}$ influences current DLOWRATIO. I cannot determine the direction of the influence because the sum of the coefficients of lagged PRESSURE$_{dum}$ is not insignificantly different from zero.

With the remaining three measures of PRESSURE, I estimate for the large and small banks the models in (11) and (12).

$$RISK_{it} = \beta_3 + \sum_{j=1}^{4} c_j RISK_{i(t-j)} + \sum_{j=1}^{4} d_j PRESSURE_{i(t-j)} + e_{t3} \quad (11)$$

$$PRESSURE_{it} = \theta_3 + \sum_{j=1}^{4} e_j PRESSURE_{i(t-j)} + \sum_{j=1}^{4} f_j RISK_{i(t-j)} + \nu_{t3}. \quad (12)$$

For the smallest 19 banks, I can reject the null hypothesis (at the 5% level) that PRESSURE$_{all}$ is not causally

prior to DLOWRATIO. The sum of the lagged coefficients of $PRESSURE_{all}$ is not insignificantly different from zero. For the smaller 47 banks, I can reject (at the 5% level) the null hypotheses that $PRESSURE_{all}$ and $PRESSURE_{cap}$ are not causally prior to DLOWRATIO; the sum of the coefficients of $PRESSURE_{cap}$ is significantly negative at the 5% level. This implies that as rating declines, the ratio increases. Thus risk decreases.

For the smaller 47 banks, I can reject the null hypotheses (at the 5% level) that $PRESSURE_{unadj}$, $PRESSURE_{cap}$, and $PRESSURE_{all}$ are not causally prior to DVAR. Only the sum of the coefficients of $PRESSURE_{cap}$ is significantly different from zero. The sum is positive, which implies that prior declines in rating result in a decline in asset risk as measured by DVAR.[5]

Finally, only for the smallest 19 banks in the sample do I find a significant relationship between prior $PRESSURE_{cap}$ (and $PRESSURE_{all}$) and the current measure of interest rate risk, DSHORT. The sums of the lagged coefficients of $PRESSURE_{cap}$ and $PRESSURE_{all}$ are significantly negative (at the 1% level), which implies that as rating declines, interest rate risk increases. This is the only indication that small

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[5] I reject the null hypotheses that $PRESSURE_{unadj}$ and $PRESSURE_{all}$ are not causally prior to DVAR at the smallest 19 banks in the sample. The direction of the influence is indeterminant.

banks **increase** risk following an increase in regulatory pressure.

For the largest 20 banks in the sample, I consistently find a significant **positive** relationship (at the 1% level) between prior $PRESSURE_{all}$, $PRESSURE_{cap}$, and $PRESSURE_{unadj}$ and current DLOWRATIO. This implies that this group of banks becomes riskier as ratings decline.[6]

Further, I find a significant relationship (at the 5% level) between prior $PRESSURE_{all}$, $PRESSURE_{cap}$, and $PRESSURE_{unadj}$ and current DVAR. Only the sum of the coefficients of $PRESSURE_{cap}$ are significantly different (at the 5% level) from zero; the sign of the sum indicates that as the capital rating declines, asset risk increases. For the 11 TBTF banks, I find a similar relationship. Prior $PRESSURE_{unadj}$ and $PRESSURE_{cap}$ are significantly (at the 1% level) negatively correlated with current DVAR.

The Granger tests suggest the possibility that in terms of DLOWRATIO and DVAR, large and small banks are responding differently to regulatory pressure. The direction of the difference is consistent with my earlier finding that capital regulation is effective for the small banks (however they are define) in the sample, but not the large banks. So, I use the

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[6] This result maintains for $PRESSURE_{unadj}$ and $PRESSURE_{cap}$ if I define large banks as the 11 TBTF banks in the sample.

Chow test to determine if pooling large and small banks is inappropriate.

When I define large and small banks as the largest one-third and the smallest one-third of the sample, I reject at the 1% level the null hypothesis that pooling is appropriate. This result is invariant to the measure of regulatory pressure. The results are less significant when I define large banks as the 11 TBTF banks and small banks as the remaining 47. I continue to reject the null hypothesis when I use $PRESSURE_{unadj}$ and $PRESSURE_{cap}$, but the significance level declines to 5%.

Finally, I have no evidence that increases in risk increase regulatory pressure. This contrasts with the conclusion by Duan et al. In only a limited number of cases can I reject the null hypothesis that RISK is causally prior to PRESSURE. In those situations where I reject the null hypothesis, the direction of the influence of RISK on PRESSURE is inconsistent with effective regulation.

Conclusion. When I examine the results within the context of the predictions of the Koehn and Santomero and Furlong and Keeley models, I reach this conclusion. Regulatory pressure does not lead to additional risk-taking by banks most likely to respond to pressure with improvements in capital, i.e. the small banks.

For banks not likely to improve capital, i.e., the large banks, there is a contrast in the results of the means tests and the Granger causality tests. The means tests, which distinguishes between those banks likely to be subject to increased regulatory scrutiny and sanctions from those that are not, suggest that the poorly capitalized large banks are effectively discouraged from taking on additional risk.

Yet, the Granger tests based on $PRESSURE_{unadj}$, $PRESSURE_{cap}$ and $PRESSURE_{all}$ suggest that increases in regulatory pressure lead to increases in risk at the large banks. (Further, in terms of risk-taking, the large banks are behaving significantly differently from the small banks.) The conclusions from the two sets of tests are not necessarily inconsistent. Taken together, the differing conclusions imply that there are degrees of regulatory pressure, not properly distinguished by the $BANKS_{much}/BANKS_{little}$ dichotomy, that can lead to additional risk-taking by banks that are resistant to capital requirements.

CHAPTER 6
CAPITAL REGULATION AND DIVESTITURES

Background

The value of an asset to a bank equals the sum of (1) the present value of the cash flows arising from the asset's continued use by the bank, and (2) the present value of the asset's contribution to the deposit insurance subsidy. In an unregulated environment, a bidder offering a price equal to the sum of (1) and (2) does not provide the bank with an incentive to divest.

Slovin, Sushka and Polonchek (1989) argue that the market perceives capital regulation as a motivation for a sale-and-leaseback or divestiture that would not occur in an unregulated environment. In other words, the market predicts either event because regulators compel management to improve the book capital ratios. Instead of relying on future retained earnings, the bank opts for a divestiture or sale-and-leaseback. While market capital will not change, book capital increases by the amount of the extraordinary gain the bank recognizes on the sale.

This perception of capital regulation leads the market to view indiscriminately divestiture or sale-and-leaseback

announcements by banks as signals of weaker earnings in the future. Even if the bidder offers a premium for the asset, the market will discount part if not all the gain. So, Slovin et al. hypothesize that a bank's announcement of a sale-and-leaseback or divestiture will not create the significant wealth gain that has been shown to accrue to the shareholders of non-bank firms.

To test this hypothesis, they look at the equity market's reaction to the announcement of sale-and-leasebacks and divestitures by bank holding companies. For the full sample of sale-and-leasebacks, the two day abnormal return around the announcement is an insignificant -.86%. Further, 72% of the returns are negative. For the full sample of initial divestitures, the two day abnormal return is a significant .86%.[1] Announcements of subsequent divestitures produce no abnormal return. Since the abnormal returns are significantly lower than similar returns for non-bank firms, Slovin et al. conclude that the evidence supports their hypothesis.

Using the capital-deficient/sufficient classification in Keeley (1988), Slovin et al. compare the announcement effects

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[1] Slovin, et al. separate the announcements of a first divestiture in the period examined from the announcements of subsequent divestitures. They argue that once an initial divestiture has been announced, the market may anticipate the subsequent divestitures, and not react to the announcements. So, any market reaction to the initial divestiture may not be apparent if this distinction is not made.

across classes of banks. Their purpose is to link the wealth change to the capital position of the divesting bank. For capital-deficient banks, the two-day abnormal returns at the announcement of (1) a sale-and-leaseback, (2) an initial divestiture, and (2) any subsequent divestitures are positive, but not significantly different from zero.

For capital-sufficient banks, the announcement of a sale-and-leaseback produces significantly negative abnormal returns. The announcement of an initial divestiture produces a significantly positive abnormal return. Yet the size of the return is smaller than that for a non-bank firm.

Slovin et al. interpret the difference in the market's reaction in the following manner. Capital-deficient banks announcing divestitures do not surprise the market, which anticipated the announcement.[2] Yet, a similar announcement by a capital-sufficient bank is a surprise, which the market interprets as bad news.

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[2] There are several options available to a capital-deficient banks for augmenting capital. Slovin, et al. are not clear in explaining how the market can know a bank will select specifically a divestiture. They could argue that the market, aware of the balance sheet of the bank, can make a guess of the mostly likely method. If the market guesses wrong, then a price revaluation will occur at the announcement of some other capital increasing activity. Since the sample is composed of divestiture events (as opposed to announcements of dividend cuts, equity issuance, etc.), one can argue that the divestiture is an unbiased estimate of the bank's actual method for augmenting capital. Thus for this particular sample, the market's average guess is correct, and no price revaluation occurs.

A weakness of the Slovin et al. study stems from the testing of joint hypotheses. The stated null hypotheses, which they reject, are:

1. abnormal returns around a divestiture announcement are not lower than the abnormal returns accruing to a non-bank firm, and
2. capital positions do not affect the returns accruing to bank shareholders from a divestiture or sale-and-leaseback.

Both hypotheses hinge on an implied null hypothesis that for the period 1975-1986 the market does not view capital regulation as effective. Now, there is room to doubt that this implied null hypothesis can be rejected. Evidence from studies of capital regulation prior to December 1981 suggests that capital regulation is not effective. My study of 1984-1986 suggests that the regulators do not influence book capital levels at the large banks in my sample. If I doubt the rejection of the implied null hypothesis, then I question how Slovin et al. can reject the two stated null hypotheses.

I undertake tests similar to those of Slovin et al. by using capital adequacy ratings as an indicator of banks under regulatory pressure.[3] I have 28 divestiture events, 19 of

[3] In Chapters 2,4, and 5, I maintain that capital adequacy ratings are a better predictor of banks under regulatory pressure than are minimum primary capital requirements. In this chapter, I use ratings to analyze the market's reaction to divestitures announcements. So, for hypothesis testing, I am assuming that the market, in observing banks under regulatory pressure, has the information that regulators use to decide the rating. There is the possibility that such an assumption is false. Unfortunately,

which are announced by the largest one-third of my sample. In developing hypotheses, I assume that the market doubts the ability of regulators to control the capital. Since there is evidence that supports this for most of the banks in my divestiture sample, I avoid joint hypotheses.

An Event Study of the Issue

The null hypothesis. My null hypothesis is the following: differing levels of regulatory pressure does not explain the differences in abnormal returns around divestiture announcements. I base this hypothesis on the notion that the market does not view capital regulation as effective. So, the degree to which a bank is under regulatory pressure will not help the market predict a divestiture.

I test the null hypothesis by comparing abnormal returns of banks under much regulatory pressure with those of banks under little regulatory pressure. I measure regulatory pressure by the level of the capital adequacy rating and the overall CAMEL rating at the divestiture announcement.

Description of the data. My sample has 28 divestiture events. I collected the events by scanning the Wall Street

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I cannot examine the robustness of my results by using the minimum capital requirements as do Slovin, et al. With one or two exceptions, the banks in my divestiture/sale-and-leaseback sample have primary book capital ratios below the 5.5% requirement.

Journal Index for the period 1984-1986 for the 58 bank holding companies in my sample. I recognized initial announcements of 53 divestitures, but 22 have dates that are the same or within two days of announcements of a non-divestiture event. I eliminated three additional announcements because of the lack of market price data.

I liberally define a divestiture. A description of the event and the rate of its occurrence in the final sample are as follows:

Sale of office building or corporate headquarters:	7
Sale-and-leaseback of headquarters:	1
Sale of problem loans and real estate:	1
Sale of a unit of a recent acquisition:	2
Sale of ownership in another firm:	1
Sale of a subsidiary, banking or otherwise:	16
Total	28

The entire sample of divestitures is split about equally between healthy and unhealthy banks. Sixty-four percent of the total observations has a capital adequacy rating of 2 or better. Fifty-four percent has an overall rating of 2 or better.

Description of the methodology and results . I estimate the two day abnormal returns around the announcement of the divestiture for each event. I use the methodology in James (1987). This requires estimating (by ordinary least squares) the model in (13) by using 80 daily returns prior to t=-10, where t=0 is the date of the announcement.

$$R_{it}=\alpha_i+\beta_i R_{mt}. \quad (13)$$

R_i is the daily return for $bank_i$, and R_{mt} is the daily return on a value-weighted market index comprised of the securities on the Center for Research in Securities Prices (CRSP) tape.

The event window is 10 days centered on t=0 for each prediction error (PE_{it}) and standardized prediction error (SPE_{it}). I define these errors in Equations 14 and 15.

$$PE_{it}=R_{it}-(\alpha_i+\beta_i R_{mt}) \quad (14)$$

$$SPE_{it}=\frac{PE_{it}}{1+\frac{1}{T}+\frac{(R_{mt}-\bar{R}_m)^2}{\sum_{j=1}^{T}(R_{mj}-\bar{R}_m)^2}} \quad (15)$$

T is the number of observations in the estimation period t= -80 to t= -10.

From SPE_{it}, I find a two day standardized prediction error, STERRDAY.

$$STERRDAY_i=(SPE_{i,-1}+SPE_{i,0})/\sqrt{2}$$

I use $STERRDAY_i$ to test hypotheses. I define a "mean" STERRDAY as

$$\text{Mean STERRDAY} = \frac{\sum_{n=1}^{obs} \text{STERRDAY}_n}{\sqrt{obs}}.$$

In Table 20, I report the STERRDAY for each divestiture announcement. Only 2 out of the 28 events produce significant wealth changes. Both are wealth gains to shareholders of banks with a capital and overall rating of 4.

In Table 21, I perform tests similar to those in Slovin et al. I look at the differential wealth effects that arise because of differences in regulatory pressure. I treat banks with a capital or an overall rating of 3, 4, or 5 as equivalent to the capital inadequate banks of Slovin et al. Banks with ratings of 1 or 2 are equivalent to their capital adequate banks.

Banks with ratings (capital or overall) of 3, 4, or 5 produce mean STERRDAYs that are positive and significant.[4] The results are contrary to finding in Slovin et al. of no significant announcement effect.

The banks with ratings of 1 or 2 produce negative (OVERALL) and positive (CAPRATE) returns, but the returns are insignificant. This is contrary with the finding by

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[4] The large STERRDAY of 4.15 is driving the results. If I omit this outlier, the mean STERRDAY drops to 0.8513 for either measure of regulatory pressure.

TABLE 20
THE STANDARDIZED ABNORMAL RETURNS ASSOCIATED WITH EACH DIVESTITURE ANNOUNCEMENT.

OBS	STERRDAY$_i$[a]	CAPRATE$_i$[b]	OVERALL$_i$[c]	SIZE$_i$[d]
1	-0.4202	3	3	L
2	1.6616	3	4	L
3	-1.2309	4	4	L
4	4.1125*	4	4	L
5	-0.1038	4	4	L
6	0.0317	2	2	L
7	-0.0619	2	2	L
8	-1.7213	2	2	L
9	0.5408	2	2	L
10	0.8672	3	3	L
11	-1.0665	3	3	L
12	2.6617*	4	4	L
13	0.4710	4	4	L
14	-0.1281	2	3	M
15	-0.0940	2	3	L
16	-1.6442	2	2	L
17	-0.56850	2	2	L
18	-0.25990	2	2	L
19	0.61640	2	3	L
20	-1.20080	2	2	L
21	0.85072	2	2	M
22	0.07160	2	1	S
23	1.59553	2	2	M
24	1.27816	1	1	M
25	1.91273	2	2	M
26	-0.76776	1	2	M
27	-0.41916	2	1	M
28	-0.28614	3	4	S

* significant at 5% level or better (two-tailed test).

[a] STERRDAY is the standardized prediction error over the period t=-1 to t=0, where t=0 is the day of the divestiture announcement.

[b] CAPRATE is the capital adequacy rating for the quarter in which the announcement occurs. It ranges from 1 (best) to 5 (worst).

[c] OVERALL is the overall CAMEL rating for the quarter in which the announcement occurs. It ranges from 1 (best) to 5 (worst).

[d] SIZE indicates whether the observation is from the sample subset composed of the largest 20 sample banks (L), the middle 19 banks (M), or the smallest sample banks (S). I

TABLE 20--continued

base size on the average lead bank assets over the 12 quarters in the 1984-1986 period.

TABLE 21
DIFFERENTIAL EFFECTS OF REGULATORY
PRESSURE ON STERRDAY

	CAPRATE[b]		OVERALL[c]	
	1-2	3-5	1-2	3-5
Obs	18	10	15	13
STERRDAY[a] Mean	0.008	2.108**	-0.093	1.96*
%negative	55%	50%	53%	54%

* significant at 5%.
** significant at 2.8%.
[a] STERRDAY is the standardized prediction error over the period t=-1 to t=0, where t=0 is the day of the divestiture announcement. The mean is the sum of the STERRDAYs divided by the square root of the number of observations in the particular CAPRATE, or OVERALL category.
[b] CAPRATE is the capital adequacy rating for the quarter in which the announcement occurs. It ranges from 1 (best) to 5 (worst).
[c] OVERALL is the overall CAMEL rating for the quarter in which the announcement occurs. It ranges from 1 (best) to 5 (worst).

Slovin et al. of a significant negative announcement effect for sale-and-leasebacks, and significant positive abnormal return for an initial divestiture by capital adequate banks.[5]

As a final test, I use weighted least squares to regress the STERRDAY on dummy variables that indicate rating. I report the results in Table 22.

The null hypotheses, which I am unable to reject for β_1, and β_2, state that the level of rating does not affect the wealth effect of a divestiture announcement. So, while I do find some STERRDAYs that are significantly different from zero, the wealth effects between groups are not significantly different.

Conclusion. Slovin et al. observe that the abnormal returns to the shareholders of banks that divest are consistently less than those to shareholders of non-banks that divest. They hypothesize that the presence of effective capital regulation negatively biases the market's reaction to a divestiture announcement. This bias represents a cost imposed by capital regulation on bank shareholders.

My sample of bank divestitures does not reveal the wealth effects that are associated with non-bank divestiture

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[5] Comparisons of my results with those of Slovin, et al. is not completely fair because I do not examine separately sale-and-leasebacks, initial divestitures, and subsequent divestitures. Slovin, et al. do not aggregate their sample of events, so a completely fair comparison is not possible.

TABLE 22
REGRESSION OF STERRDAY ON RATINGS AND SIZE

Model 1: $STERRDAY_i$[a] $= \alpha_1 + \beta_1 WCAP_i$[b] $+ \epsilon_1$.

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEPT	1	0.013390	0.30545659	0.044	0.9654
WCAP	1	0.011465	0.00921019	1.245	0.2243

Model 2: $STERRDAY^{i}$[a] $= \alpha_2 + \beta_2 WOVER_i$[c] $+ \epsilon_2$.

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEPT	1	0.023687	0.33485300	0.071	0.9441
WOVER	1	0.007952	0.00827678	0.961	0.3455

[a] $STERRDAY_i$ is the standardized prediction error over the period t=-1 to t=0, where t=0 is the day of the divestiture announcement.

[b] $WCAP_i$ is a dummy variable weighted by the standard deviation of the residuals$_i$ for the estimation period, t=-11 to t=-91. The dummy is 1 if the capital rating is 3, 4, or 5 and 0 if the rating is 1 or 2 at the time of the divestiture announcement.

[c] $WOVER_i$ is a dummy variable weighted by the standard deviation of the residuals$_i$ for the estimation period, t=-11 to t=-91. The dummy is 1 if the overall CAMEL rating is 3, 4, or 5 and 0 if the rating is 1 or 2 at the time of the divestiture announcement.

announcements. In this regard, my results are similar to those of Slovin et al. Yet, I cannot link this phenomenon to capital regulation. I do not find that the degree to which a bank is subject to regulatory pressure explains the wealth effects apparent in my sample. So, unlike Slovin et al., I do not conclude that capital regulation imposes costs on stockholders by forcing management to undertake a divestiture it would not otherwise consider. Given that 68% of the divestiture sample is produced by the largest 20 banks, my finding that shareholders bear no cost is not surprising.

CHAPTER 7
SUMMARY OF CONCLUSIONS

In Chapter 3, I find that regulatory pressure reinforced by increased regulatory supervision and the threat of sanctions leads to increases in capital ratios at the small banks in the sample. This true for small banks defined as the smallest one-third of the sample or defined as all but the 11 "too big to fail" (TBTF) banks. Further, as revealed in Chapter 4, these improvements in capital are not the result of window-dressing; they represent authentic increases in the capital cushion. This implies that effective regulation of book capital is likely to lead to effective regulation of market capital. Finally, in Chapter 5, the evidence suggests that increases in book capital are not offset by increases in risk-taking.

My conclusions are comparable to those developed in Keeley (1988) and Furlong (1988), which examine capital regulation following the passage of minimum capital standards in 1981. Yet, my findings suggest that capital regulation derives strength from increased regulatory supervision and

interference, not from the minimum capital requirements.[1] Keeley and Furlong cannot draw the same conclusion since a bank that falls below the minimum requirements is not necessarily subjected to the same scrutiny as a bank that drops to a capital rating of 3 or worse.

To produce these results, I use the means tests that separate banks under much regulatory pressure (a capital rating of 3 or worse) from banks under little regulatory pressure (a capital rating of 1). I find that, between the two groups of banks, there are statistically significant differences in cumulative growth of book capital.[2] I then strengthen this conclusion by using Granger causality tests that control for the impact of prior changes in book capital on the current change. To perform this Granger test, I use a measure of regulatory pressure, $PRESSURE_{dum}$, that is identical with the measure used in the means tests.

To test the effectiveness of regulatory pressure less extreme than that ensuing from ratings of 3 or worse, I develop a measure of regulatory pressure that is not dichotomous. I use the product of the change in capital rating

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[1] This observation lends credence to my argument in Chapters 2 and 5 that Keeley's and Furlong's results could be a spurious correlation between capital requirements and capital changes or risk changes.

[2] As I have noted, this conclusion applies to the small banks in the sample.

and the level of the capital rating prior to the change.[3] Using this measure of regulatory pressure does not suggest that each level of the capital adequacy rating represents an effective degree of regulatory pressure.

Yet, the threat of increased supervision and sanctions does not sufficiently pressure the large banks in the sample to recapitalize. This is true if I define large banks as the largest one-third of the sample or the 11 TBTF banks. Further, I find that increased regulatory pressure on the large banks can lead to increased risk-taking.

My results have the following policy implication for the banks in my sample. The risk-based capital standards that will be fully implemented by 1992 are an extension of the minimum capital standards first passed in 1981. The new standards are the first attempt to link explicitly capital requirements to the riskiness of the bank. My research clearly demonstrates the inadvisability of efforts to **substitute** these risk-based requirements for regulatory supervision.

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[3] I also use the level of the overall CAMEL rating to construct this measure. The test results are the same.

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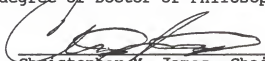
BIOGRAPHICAL SKETCH

Carol Sloan Swindle was born in Arkansas on April 16, 1958. She holds a Bachelor of Arts in economics (1980) from Hendrix College, Conway, Arkansas, and a Master of Business Administration (1982) from Tulane University, New Orleans, Louisiana.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and its fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



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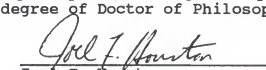

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This dissertation was submitted to the Graduate Faculty of the Department of Finance, Insurance and Real Estate in the College of Business Administration and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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